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WOLLENWEBER (H. W.). **'Zum Kiefernsterben in Nordwest-Deutschland'. Oedocephalum-Polyporus annosus.** [On the dying-off of Pines in north-west Germany. *Oedocephalum-Polyporus annosus.*]—*Forstarch.*, *1931*, 20, p. 391, 1931.

Further investigations are stated to have confirmed Liese's supposition that the *Oedocephalum* isolated from diseased pine roots in north-west Germany is the conidial stage of *Polyporus* [*Fomes*] *annosus* [*R.A.M.*, xi, p. 82]. Except in size, the conidial heads of the species isolated from pine appear to be identical with those of *O. glomerulosum* figured by Harz (*Bull. Soc. Nat. Moscou*, xliv, p. 120, 1871) as *Haplotrichum.*

FISCHER (E.). **Die Beziehungen zwischen Gymnosporangium confusum Plowr. auf Juniperus phoenicea und J. sabina.** [The relationships between *Gymnosporangium confusum* Plowr. on *Juniperus phoenicea* and *J. sabina.*]—Reprinted from *Ber. Schweiz. Bot. Gesellsch*, xl, 1, 8 pp., 1931.

Continuing his investigations on *Gymnosporangium confusum* [*R.A.M.*, ix, p. 754], the writer conducted a series of inoculation experiments at Berne to ascertain the reason for the toxic manifestations produced on *Cydonia vulgaris* by the Mediterranean form of the rust from *Juniperus phoenicea*, in contrast to the Central European form from *J. sabina* which is characterized by profuse aecidial formation (practically absent in the Mediterranean form) but causes little damage to the quince host.

Inoculations on *C. vulgaris* with teleutospores from *J. sabina* caused extensive rotting of the leaves of plants kept in a warm house and this was followed in several cases by the development of swollen aecidial pustules. It was found also that the aecidiospores of the form from *J. sabina* were able to infect *J. phoenicea*, indicating that both are the same strain of *G. confusum.* The difference in virulence on *C. vulgaris* is thus not genotypical, nor is it dependent on the condition of the host, but is apparently governed by environmental factors.

POPHAM (F. J.). **Summary of results of treated experimental sleepers laid in the various railway systems of India, brought up to date.**—*Forest Bull.* 74 (Forest Res. Inst., Dehra Dun), 30 pp., 1931.

The results [which are briefly discussed and fully tabulated] of durability tests of treated railway sleepers in India begun in 1910

show that neither carbolineum Avenarius nor mixtures of zinc chloride and carbolineum are altogether satisfactory for this purpose, their failure being due to low absorption on the part of the carbolineum and to the leaching out of the zinc chloride. Considerably better results were obtained with Powell's solution (molasses and arsenic) [*R.A.M.*, viii, p. 80] and with a mixture of solignum and earth oil in the treatment of *Pinus longifolia*, *P. excelsa*, and *Terminalia tomentosa*, the average life of the last-named being extended by Powellizing from 6 to 18½ and 17 years on the Eastern Bengal and North-western Railways, respectively, while the solignum and oil treatment prolonged the life of the two *Pinus* spp. from 3 to 14 years on the North-western. Powellizing has also given satisfactory protection against fungus rots in the Karachi division, but probably the creosote and oil treatment is better suited to very humid climates.

KROHN (V.). **Die ersten Funde von Phytomonas maculicola McCulloch in Suomi.** [The first discoveries of *Phytomonas maculicola* McCulloch in Finland.]—*Phytopath. Zeitschr.*, iii, 5, pp. 531–532, 1931.

From a leaf of *Brassica oleracea* submitted to the Phytopathological Institute of Helsingfors University in the autumn of 1928, an organism was isolated corresponding in its morphological and cultural characters [which are indicated] to *Phytomonas* [*Pseudomonas*] *maculicola* [*R.A.M.*, vii, pp. 226, 563; viii, p. 120]. The spots on both sides of the leaf were blackish-brown to black, hard, surrounded by a yellowish border, and measured 1 to 2 mm. across, but were sometimes confluent. In the larger lesions the affected tissues generally fell out, leaving a grey surrounding zone. Inoculation experiments with a pure culture of *P. maculicola* gave positive results on cauliflower and Brussels sprouts, while head cabbage [*B. oleracea* var. *capitata*] remained immune. *P. maculicola* was subsequently detected on cabbage plants in south-west Karella and elsewhere in Finland.

PRESTON (N. C.). **The prevention of finger-and-toe (club-root) in gardens and allotments.**—*Journ. Min. Agric.*, xxxviii, 3, pp. 272–284, 1 pl., 1931.

This is an expanded version of the author's account of experiments on the control of the finger-and-toe disease (*Plasmodiophora brassicae*) of cruciferous crops, which have already been noticed [*R.A.M.*, ix, p. 699]. In addition to the information contained in the first paper, mercurous chloride (calomel) is stated to have given definitely encouraging results in the control of the disease, and has the advantages of very easy application and a much lower toxicity to man than mercuric chloride. Calcium cyanamide and nitro-chalk did not afford any practical measure of protection under the conditions of the tests. Emphasis is laid on the necessity of disinfecting seed-beds infected with the organism, for which purpose the use of 0.1 per cent. mercuric chloride or 2 per cent. formalin solution, at the rate of about 2 gallons per square yard, is recommended.

The cost of the mercuric chloride (1 in 2,000 solution) treatment in the field by the 'watering-in' system, and allowing half a pint

per plant, is estimated to be about 3*d.* or 4*d.* per 100 plants; where the 'dipping' method is used, the cost would be reduced to about 1*d.* per 100 plants treated, but this method appears to be definitely inferior to the other.

WENZEL (A.). **Beiträge zur Kenntnis der Blattfleckenkrankheiten der Zuckerrübe. (Dissertationsauszug.)** [Contributions to the knowledge of the leaf spot diseases of the Sugar Beet. (Abstract of a thesis.)]—*Phytopath. Zeitschr.*, iii, 5, pp. 519–529, 10 figs., 1931.

The writer summarizes the results of his observations in the Rhine Province on the leaf spot diseases of sugar beets caused by *Cercospora beticola*, *Ramularia betae* and *Alternaria tenuis* (*Sporidesmium putrefaciens*).

The results of the present investigations on the first-named disease are stated to agree in the main with those of Schmidt [*R.A.M.*, vii, p. 694]. *Ramularia betae* occurred in a parasitic form in 1928 (the first report in Germany) at Bonn, Düren, and on the Moselle [ibid., ix, p. 757]. The spots produced by this fungus closely resemble those due to *C. beticola*, except that they are distinctly paler, usually larger, and with less regular margins. The conidia of *R. betae* are uni- or bicellular, tapering at both ends, the former measuring 10 to 15 by 4 to 5 μ and the latter 15 by 5 μ. The mycelium grows very slowly, conidia developing at the apex of any free hypha. The optimum temperature for growth is 18° to 20° C. At 17° the incubation period in artificial infections was 16 to 18 days, while at 28° it was 26 days and at the latter temperature the percentage of successful infections was very low. Infection takes place through the stomata. *R. betae* (a common beet parasite in Denmark) does not normally find in Germany the optimum temperature relations for its development. The *Ramularia* spots, unlike those of *C. beticola* [ibid., viii, p. 120], are not separated by an abscission layer from the healthy areas.

When unwounded beet leaves at an advanced stage of development were inoculated with a conidial suspension of *Alternaria tenuis* (*Sporidesmium* [*Sporodesmium*] *putrefaciens*) [ibid., iv, p. 61; x, p. 293], no spotting developed, but lesions appeared on wilting leaves wounded prior to inoculation. Infection further occurred in portions of the tissue injured by dilute sulphuric acid or leaf-miners. The fungus fruited profusely on all the spots and completely destroyed the leaves in the greenhouse at a temperature of 25° and 100 per cent. humidity. Beet leaves narcotized with ethyl ether at a strength of 0·25 c.c. per l. of air were also entirely disorganized by *A. tenuis*. The results of these experiments are considered to show that *A. tenuis* is an innocuous facultative parasite, only capable of injuring the plants after their vital functions are weakened.

BRANDENBURG (E.). **Die Herz- und Trockenfäule der Rüben als Bormangel-Erscheinung.** [The heart and dry rot of Beets as a symptom of boron deficiency.]—*Phytopath. Zeitschr.*, iii, 5, pp. 499–517, 4 figs., 1931.

Recent physiological investigations [which are summarized] have

shown that boron is one of the indispensable elements of plant nutrition, the absence of which is responsible for the death of the growing point in various plants, e.g., broad beans (*Vicia faba*), tomato, and tobacco [cf. *R.A.M.*, x, p. 561].

In the writer's experiments [full details of which are given] at Baarn, Holland, Eckendorfer fodder beets, raised from sterilized seed in glass vessels containing v. d. Crone's solution (P_H 6 to 7), developed the typical symptoms of heart rot [ibid., iv, p. 521 *et passim*] accompanied by more or less pronounced chlorosis of the leaves. By the addition of boric acid to the solution at the rate of 0·5 to 0·7 mg. per l. the heart rot symptoms were entirely eliminated, while manganese sulphate (1 mg. per l.) prevented the development of chlorosis.

The early symptoms of boron deficiency always appear in the youngest heart leaves, which cease to grow and often bend slightly outwards, while a blackish-brown discoloration is observed, especially on the concave side of the petioles, frequently extending to the mid-rib and lateral veins in the basal parts of the smallest leaves. In the larger leaves the veins are often somewhat yellowish instead of whitish as in normal plants. The affected petioles are extremely brittle. In the continued absence of boron the heart leaves and main growing point rapidly turn black and die, while the next older leaves wilt, turn yellow, and shrivel. At the same time numerous new shoots develop from the healthy parts of the beet, but these also become similarly diseased. The outer leaves of the plants deprived of boron are often drooping and unusually thick. The lateral roots of affected plants are generally brownish, very short, and die off at the tips, while the many new ones formed to replace them cease to grow on reaching the length of a few millimetres.

These symptoms agree with those occurring under field conditions. The actual dry rot symptoms also developed in the roots of beet plants grown in water cultures without boron. The affected tissues showed a diffuse, very marked, brown to black discoloration, accompanied in the advanced stages by desiccation and necrosis. In very rare cases the exterior cambial zone lower down on the root was also involved, as described by Krüger and Wimmer [ibid., vii, p. 759]. No trace of infection by *Phoma betae* was detected in the water culture plants, and although this fungus was very often isolated from advanced cases of heart rot in the field, it is considered to be of little or no importance in the etiology of the disease.

In a small-scale pot experiment, in which fodder beets growing in sandy humus soil were supplied, immediately on the appearance of boron deficiency symptoms, with boric acid at the rate of 5 mg. per 8 kg. soil, complete recovery was effected, while in the untreated control plants the disease pursued its natural course as described above.

The 'late blight' of sugar beets recently reported from the United States [ibid., x, p. 576] is considered, from the account of the symptoms and the accompanying figures, to be distinct from heart and dry rot.

[A condensed version of this paper is published in *Angew. Bot.*, xiii, 5, pp. 453–456, 1931.]

MIKLASZEWSKI (S.). **Dry rot of Sugar Beet in relation to soil conditions.**—*Proc. Internat. Soc. Soil Sci.*, iv, pp. 75–77, 1931. [Abs. in *Journ. Soc. Chem. Ind.*, l, 44, p. 990, 1931.]

Dry rot of sugar beets [see preceding abstract] is stated to occur only in alkaline soils in Poland. It is immaterial whether the alkalinity is natural or induced by liming. The development of the disease is partially related to the proportionately lower water content of the alkaline soils.

MOORE (W. D.). **Pod blight of Lima Beans in North Carolina and Virginia.**—*Plant Disease Reporter*, xv, 11, pp. 113–114, 1931. [Mimeographed.]

In August, 1931, the writer observed an apparently new disease of Lima beans [*Phaseolus lunatus*] in a 20-acre field at Goldsboro, North Carolina. The causal organism of the disease has not yet been accurately determined but is similar to *Colletotrichum canlicola*. In the early stages the pods show small reddish streaks and blotches which rapidly expand. Later the infected areas turn light brown to greyish and numerous fruiting bodies develop on the surface, while the branches are also girdled and killed. The pod spot fungus (*Diaporthe phaseolorum*) [*R.A.M.*, iv, pp. 82, 136] was often found in association with that of pod blight. Subsequently the disease was found causing up to 100 per cent. infection in the Norfolk district of Virginia, where the stems also were generally involved. Pod blight may cause the loss of the entire crop.

MOORE (W. D.). **Ashy stem blight on Lima Beans in North and South Carolina.**—*Plant Disease Reporter*, xv, 11, pp. 114–115, 1931. [Mimeographed.]

During the summer of 1931 a three-acre field of Lima beans [*Phaseolus lunatus*] near Lake City was found to be heavily infected by ashy stem blight (*Macrophoma* [*Macrophomina*] *phaseoli*) [*R.A.M.*, ix, p. 82], this being apparently the first record of the disease in the State. In some cases the entire plant was killed and numerous typical pycnidia developed on the ashy-white areas of the dead stems. Ashy stem blight further occurred in a milder form in the Wilmington district. Owing to the resemblance between this disease and the pod spot due to *Diaporthe phaseolorum* [see preceding abstract], it is possible that confusion may have arisen in certain cases, and that ashy stem blight is more generally present than the records show.

KAWAMURA (E.). **A leaf spot of Vigna catjang var. sinensis, caused by Cercospora vignicola n. sp.**—*Fungi* (*Nippon Fungological Soc.*), i, 1, pp. 14–20, 1 fig., 1931. [Japanese, with English summary.]

Cowpea (*Vigna catjang* var. *sinensis*) has been attacked in Fukuoka, Japan, by a new disease the symptoms of which are the appearance of circular, concentrically zonate spots with reddish-brown rings, 4 to 8 mm. in diameter, on the leaves, and long, dark reddish brown lesions on the stems. The causal organism, which is named *Cercospora vignicola* n. sp., is characterized by simple, erect, dark brown conidiophores (paler towards the apex), arising

singly or in fascicles from the diseased areas, sometimes constricted at the septa, of which there are 1 to 7, and measuring 50 to 228 by 6 to 9 μ, and by terminal, obclavate, occasionally cylindrical, straight, or slightly curved, light brown conidia, tapering towards the apex, 2- to 21-septate, measuring 80 to 252 by 10 to 22 μ.

UPPAL (B. N.). **India: a new virus disease of Dolichos biflorus.** —*Internat. Bull. of Plant Protect.*, v, 9, p. 163, 1931.

In 1930 *Dolichos biflorus* at the College Farm, Poona, was observed to be severely affected by a new virus disease resembling bean (*Phaseolus vulgaris*) mosaic and characterized by chlorosis, clearing of the veins, blistering, and downward cupping of the pinnately trifoliate leaves, shedding of flowers, and extensive sterility of the pods. The disease is reported to be very serious and generally prevalent in the Bombay Presidency and has further been found causing heavy damage to *D. lablab* in Gujarat. The infective principle was found to be transmissible through the seed of *D. biflorus*, up to 25 per cent. of seed infection being found in different seed lots purchased from the market.

LABROUSSE (F.). **L'anthracnose du Pois-Chiche.** [Anthracnose of Chick Pea.]—*Rev. Path. Vég. et Ent. Agric.*, xviii, 6, pp. 226–231, 1931.

In further investigations into the disease of chick peas (*Cicer arietinum*) formerly attributed to *Phyllosticta rabiei* [*R.A.M.*, x, p. 7; xi, p. 23] the author observed that 2 to 4 per cent. of the spores in the pycnidia which developed on inoculated plants were bicellular and considers that the fungus should be referred to the genus *Ascochyta*, which also establishes a more satisfactory connexion between it and the diseases of common peas caused by *A. pisi*, *A. pinodella* [ibid., xi, p. 17], and *A. pinodes*. All of these have as a common characteristic the production of similar lesions on the stems and foliaceous organs, whereas *Phyllosticta* comprises only leaf-attacking species. *Ascochyta* is preferred to *Diplodina* because the latter includes only stem-attacking species, and also on the ground of priority. The author accordingly proposes the name *A. rabiei* (Passerini) nov. comb. for the chick pea organism.

In a field test rows of chick peas were planted alternately with rows of *Vicia faba*, *V. sativa*, *V. hirta*, *V. macrocarpa*, *Lathyrus sylvestris*, garden peas, and lentils, and fragments of chick peas killed off by the disease were deposited on the rows. As soon as the plants showed above the soil all the chick peas were killed, but the rest continued to be unaffected in spite of repeated sprinkling with an aqueous suspension of the spores of *A. rabiei* [cf. ibid., x, p. 8].

On carrot agar *A. rabiei* forms a scanty, cream-white mycelium with numerous pycnidia blackening the medium; the spores are a very pale pink, almost white in the mass. Under identical conditions, *A. pisi* forms an abundant rose-pink mycelium; the pycnidia are of a light colour and the spores in the mass are a bright carrot red.

Of 36 different types of chick peas inoculated with *A. rabiei* three remained almost completely unaffected in spite of repeated sprinkling with an aqueous suspension of the spores; two of these

types are fit for human consumption while the third is suitable for feeding to animals. Further efforts to discover resistant types are in progress.

FOISTER (C. E.). **The white tip disease of Leeks and its causal fungus, Phytophthora porri n. sp.**—*Trans. & Proc. Bot. Soc. Edinburgh*, xxx, 4, pp. 257–281, 3 figs., 1931.

This is a detailed morphological, cultural, and taxonomic account of the species of *Phytophthora* causing the so-called 'white tip' disease of leeks in Scotland [*R.A.M.*, viii, p. 543], subsequently reported also from England [ibid., x, p. 638]. The organism was shown to be capable of growing saprophytically in the soil, but there was no evidence that it attacks the roots and bases of the leek plant, infection experiments indicating that it gains entry to the host tissues through the aerial parts of the plants, to which the spores are carried by air currents. Inoculations of the leaves gave 29 per cent. infection on unwounded and 77 per cent. on slightly injured plants, and 18 per cent. of the leeks growing in proximity to diseased ones also contracted infection.

On quaker oat agar the fungus produces a dense, white mass of aerial hyphae but not much submerged mycelium; sexual organs are formed in the medium and on the aerial hyphae, where conidia are also produced. The mycelium is branched, continuous when young, but septate when old, very unequal in width, ranging from 2·4 to 12 μ, with an average of about 6 to 8 μ in diameter, and the hyphae have a great tendency to coil into spirals, particularly in the region of sexual activity; they also often develop large, long swellings which do not represent any form of spore. The sexual organs are produced very readily in the diseased tissues of leeks, and in several culture media. The antheridia are either para- or amphigynous (the predominance of either type depending on the nature of the culture medium), oval or applanate-spherical, terminal or intercalary, not on the same hypha as the oogonium; when amphigynous they range from 7·3 to 19·4 μ (average 12·5 μ) and when paragynous from 7·3 to 10 μ in diameter. The mature oogonia are spherical, with an irregularly thickened wall, ranging from 29 to 46 μ (average 38 to 39 μ) in diameter. The oospores are spherical, honey-yellow when old, with a wall 3 to 4·5 μ thick, and measure from 22 to 39 μ (average 32 to 33 μ). The conidia (which are produced abundantly in water and on the host) are obpyriform or oval, terminal or intercalary, usually without a papilla, but occasionally with a broad or beaked papilla, and measure 31 to 82 by 23 to 52 μ (average 51 by 35 μ); they germinate either by a germ-tube or by zoospores, 10 to 15 μ in diameter, which in their turn may germinate either by a tube or by forming further zoospores (repetitional diplanetism) [ibid., ix, p. 611]. The temperature relations for growth in culture were found to be: minimum below 8° C., optimum 25°, maximum 35°, and thermal death point at or slightly below 40°.

A comparison of this species with other forms [the measurements of which are presented in tabular form] leads the author to consider it as new to science, and the name *P. porri* is suggested for it. Latin and English diagnoses are appended.

ALEXANDER (L. J.) & YOUNG (H. C.). **Control of powdery mildew and red spider on greenhouse Cucumbers.**—*Science*, N.S., lxxiv, 1917, pp. 314–315, 1931.

The results of one season's tests at the Ohio Agricultural Experiment Station in the combined control of powdery mildew of greenhouse cucumbers (*Erysiphe cichoracearum*) [*R.A.M.*, x, p. 702] and red spider (*Tetranychus telarius*) indicate that spraying with hydrophilic colloidal sulphur (Anzul Chemical Company) [ibid., ii, p. 461] is very effective for this purpose. The applications were made on 11th, 20th, and 27th April and 4th May, 1931, at varying strengths up to 4 lb. of the paste to 100 galls. of water; a strength of 2 lb. to 100 galls. is recommended as both safe and efficacious. The use of penetrol [ibid., x, p. 225] as a spreader resulted in severe leaf scorch.

MULLER (H. R. A.). **Mozaiekziekte bij Cassave.** [Mosaic disease of Cassava.]—*Inst. voor Plantenziekten Bull.* 24, 17 pp., 8 pl., 1931. [French summary.]

Cassava (*Manihot utilissima*) at Buitenzorg (Java) was observed, in 1930, to show symptoms of mosaic identical, according to M. Pascalet, to whom specimens were submitted, with that already described on this host in the French Cameroons [*R.A.M.*, x, p. 639]. The disease is also believed to be the same as that termed 'Kräuselkrankheit' by Zimmermann in East Africa and with the mosaic of cassava found by Deighton and McKinney in West Africa [ibid., ix, pp. 19, 260].

The basal leaves of the affected plants at Buitenzorg appear normal, but those immediately above show a pale green to yellowish-green discoloration, sometimes affecting only half a segment or only one or two segments of a leaf. In the upper leaves more especially, the diseased parts are much reduced in size, the leaf blade consisting merely of a narrow strip along the main vein. The affected leaves often show marked curling and distortion, and the internodes are much shortened, giving the plants a stunted appearance. Very often most of the eyes on the stem grow out so that the stem bears an unusual number of lateral branches. Seedlings derived from the Brazilian 'Mangi' strain appear to be particularly susceptible to mosaic, which was found to be transmissible through cuttings.

In a note by Pascalet on the occurrence of cassava mosaic in the Cameroons [which is appended] it is stated that the average yield of a diseased crop amounts to only 15 quintals per hect. as compared with 70 to 80 quintals for a healthy one. The disease is highly infectious, and soils on which it has occurred should not be used again for cassava cultivation until a number of years have elapsed. It is suggested that scale insects (*Lecanium* sp.) and termites may act as vectors. When a healthy cassava scion is grafted on to a diseased stock and vice versa the healthy part contracts mosaic. Both sweet and bitter cassava varieties are liable to this disease, but some of the latter show a certain amount of resistance. Progress has further been made in the Cameroons in the development of resistant varieties from material received

from Central America and certain French colonies where the disease does not occur. Cassava mosaic is less severe on fresh forest soils than on those that have long been cleared. The effects of the disease may be counteracted to some extent by heavy manuring.

A table is given showing the differences between the symptoms of cassava mosaic and those of infestation by the mite, *Tetranychus bimaculatus*.

CHABROLIN (C.). **Importance économique des maladies parasitaires des cultures arbustives en Tunisie.** [Economic importance of parasitic diseases of arborescent cultures in Tunis.] —*Rev. Path. Vég. et Ent. Agric.*, xviii, 7, pp. 259–264, 1931.

In this brief review of the parasitic diseases that attack the olive, fruit trees, and the vine in Tunis, the author states that the warm Mediterranean climate in that country, wet in winter but rapidly warming up and drying in the spring, prevents a dangerous development of most of the fungal parasites, thus doing away with the necessity of routine control. The only exception is *Oidium* (*Uncinula necator*) of the vine, which regularly recurs every year and, unless checked by adequate treatment, would probably cause considerable losses. Vine mildew (*Plasmopara viticola*) is usually of little economic importance, but epidemics occurred in 1915 and 1921, showing that the disease is always present in the country and needs careful watching; under normal conditions, an early spraying of the young grape bunches is considered to afford sufficient protection against this disease.

MARSAIS (P.). **Bouillies mouillantes et adhérentes.** [Wetting and adhesive spray mixtures.]—*Rev. de Vitic.*, lxxiv, 1927, pp. 357–361, 1931.

After a few theoretical considerations on the best methods of increasing the wetting and adhesive properties of fungicidal sprays, with particular reference to cupric mixtures for the control of vine mildew [*Plasmopara viticola*], the author states that, as wettability is a function of the surface tension of the liquid, and the lower this tension the smaller the drops that flow from a calibrated drop glass with capillary orifice, such as Duclaux has used for alcohol mixtures, a fairly accurate empirical method of determining the degree of wettability of a cupric spray is by counting the number of drops from a given volume of the liquid. Thus, 5 c.c. of an efficient mixture should give from 135 to 150 drops at 15° C., the number of drops decreasing in direct proportion with decrease in the wetting capacity of the fluid. Adhesiveness is a distinct, though somewhat allied property, depending on the viscosity of the liquid. There are several suitable and well-known substances that can be added to the spray mixtures to increase this property.

As regards their application, the mixtures should be sprayed in the shape of a strong, penetrating (not spreading) jet, capable of reaching the grape bunches and entering between the individual berries [cf. *R.A.M.*, x, p. 773].

BICHET (R.). **Poudres cupriques et rots du Raisin en Beaujolais.** [Cupric dusts and Grape rots in Beaujolais.]—*Prog. Agric. et Vitic.*, xcvi, 34, pp. 181–185, 1931.

In view of the fact established in recent years that cupric dusts afford better protection to grapes against various rots, more particularly those caused by vine mildew [*Plasmopara viticola*], than cupric sprays, the author investigated the results obtained in 1930 in Beaujolais [central France] by applications of two of these dusts, namely, tetracuprite which contains 1·25 per cent. metallic copper, and is a mixture of polybasic copper sulphate, talc, and adhesol powder; and chefdebien, an intimate mixture of copper sulphate and talc, with 2·5 per cent. metallic copper content. Both dusts have a distinctly acid reaction. The doses applied varied from 15 to over 100 kg. per hect. at each dusting, the dose recommended by the makers of chefdebien being 50 to 60 kg. in normal years; there was distinct evidence that the lower doses were quite ineffective. With the higher doses both dusts gave equally good results, a noteworthy feature being that tetracuprite, which contains only half as much metallic copper as chefdebien, was at least as effective as the latter. The market price of the two dusts is practically the same, and the application of 50 kg. of either per hect. is calculated to have cost 65 francs.

The author considers that dusting the grapes may be started after the end of the flowering period, since sufficient protection is afforded until that time by the routine spraying. The investigation also showed that vine mildew cannot be efficiently controlled by dustings alone; when intercalated between sprayings they are a powerful aid in the struggle against the disease, and in this case the sprayings may be safely reduced by one or two applications during the season.

BRANAS (M.). **Le mildiou sur les producteurs-directs en 1930 à l'École Nationale d'Agriculture de Montpellier.** [The mildew on self-rooted Vine hybrids in 1930 at the National Agricultural School at Montpellier.]—*Prog. Agric. et Vitic.*, xcvi, 29, pp. 56–61, 1931.

The author states that the severe vine mildew [*Plasmopara viticola*] outbreak in France in 1930 enabled useful observations to be made at the National Agricultural School of Montpellier on the relative resistance to the disease of over 300 vine hybrids which are grown for wine production on their own roots, and none of which was treated against mildew during that season. The results [some of which are given in tabular form] showed that the hybrids possess certain properties not present in the *Vitis vinifera* parents. Thus, the different organs of the hybrid may exhibit varying degrees of susceptibility, sometimes diametrically opposed to each other, e.g., resistant foliage and susceptible grape bunches or vice versa. Susceptibility of the leaves to spring and summer attacks of the fungus was shown to be distinct from, and independent of, the susceptibility to autumn attacks, since hybrids which remain free from early infections may contract mildew in the autumn, the reverse also being true. Differences were also noted in the relative

susceptibility of the different parts of the inflorescence, the corolla being the most susceptible, and the rachis the least; frequent cases were observed, however, in which a severe infection of the corolla did not spread to the fruit. The observations showed finally that the relative resistance of a new cross cannot be foreseen in advance, and can be established only experimentally.

ARMET (H.). **Calcium et mildiou.** [Calcium and mildew.]—*Prog. Agric. et Vitic.*, xcv, 15, pp. 355–359; 16, pp. 378–382, 1931.

After pointing out that during the severe epidemic of downy mildew of the vine (*Plasmopara viticola*) which broke out in France in 1930 [*R.A.M.*, x, p. 579 and preceding abstract] certain vine varieties as well as certain parts of single vines remained unaffected, and that damp, low-lying situations and areas rich in calcium were least affected, the author states that in his opinion vines possess what he terms an 'internal' resistance to mildew, dependent on the type of the stock and graft and certain properties of the soil.

This internal resistance is conditioned in the first place by the calcium content of the aerial organs, which depends upon the amount of calcium present in the soil and its availability. An excess of calcium in the soil, by inducing chlorosis, is harmful to those vines which readily absorb this element, such as Riparia and the P.D. hybrids. Rupestris and similar stocks, as well as the native [*Vitis vinifera*] varieties, take up very little calcium flourish in soils rich in this element, and are highly susceptible to mildew.

That mature leaves remain unaffected while young ones are susceptible is considered to be due to the fact that the former contain more calcium than potassium, while in the latter the reverse obtains. The calcium : potassium ratio of the plant juices varies directly as the resistance of the organ to mildew. This ratio is much smaller for the berries than for the leaves, in which the calcium : potassium ratio becomes greater than unity about flowering time and increases rapidly from 1st July until 15th August, after which it declines. This period of rapid increase coincides with an increasing resistance in the leaves to *P. viticola*, while during the final decrease of the ratio they again become susceptible. In the berries the calcium : potassium ratio decreases during the critical period for the development of the grey rot of the berries due to *P. viticola*, i.e., from 15th June to 1st July; the ratio then increases until 15th July, to decline again during the ripening period which coincides with the critical period for the brown rot form of the disease.

The high soil humidity of rainy seasons renders the calcium and potassium more easily available; the proportion of each element taken up depends on the type of the vine and the physico-chemical constitution of the soil. Whether the results will be favourable or otherwise upon the aerial organs of the vine depends on (1) the mobility of the potassium in the plant tissues, and (2) the anti-coagulating action of the potassium on the plant sap, in opposition to the coagulating effect of the calcium. In vigorous

vines, where the sap is very fluid and rich in potassium, these two factors contribute to activate the vitality and the osmotic and nutritive exchanges which take place. In weak vines, on the other hand, in which the sap is poor in potassium and rich in calcium, these two factors act in opposition, reducing the vitality of the vines. This view is considered to confirm that recently expressed by Ravaz as to the effect of sap concentration upon fungal diseases of the vine [ibid., x, pp. 581, 640].

In very rainy years, as in 1930, the calcium : potassium ratio is probably more reduced as regards the berries than the leaves, and this would largely account for the marked susceptibility of the berries that was noticed at the different stages of their growth.

SĂVULESCU (T.). **L'état phytosanitaire en Roumanie durant l'année 1929–1930.** [Phytosanitary conditions in Rumania during the year 1929–1930.]—*Ann. Inst. Recherches Agron. de Roumanie*, iii, pp. 240–256, 1931.

Among other items of phytopathological interest in this report [cf. *R.A.M.*, x, p. 77] the following may be mentioned. *Puccinia triticina* was observed on Cenad 117 wheat on 29th April, an exceptionally early date for Rumania, and was followed 15 to 20 days later by *P. graminis* and *P. glumarum*. Wheat bunt (*Tilletia laevis*) [*T. foetens*] caused losses of 8 to 10 per cent. in untreated stands; *T. tritici* [*T. caries*] was of rare occurrence during the period under review.

Phytophthora nicotianae occurred on tobacco in the department of Orhei (Bessarabia). The appearance of *Peronospora hyoscyami*, already reported on tobacco from the Ukraine [ibid., ix, p. 2], may shortly be anticipated in Rumania, where the mildew is known to occur on *Hyoscyamus*. Leaf spotting of tobacco was caused almost exclusively by *Phyllosticta tabaci* [ibid., x, p. 692]. Considerable losses were caused by leaf necrosis of tobacco due to the *Alternaria* previously recorded by Preissecker in Hungary and various parts of the Balkans in 1916 (*Tubaksregie*, Vienna, 1–3) under the name of *A. brassicae* var. *tabaci* Preiss., the dimensions of the conidiophores being given by him as 12 to 50 by 4 to 6 μ and those of the 3- to 11-septate conidia as 30 to 107 by 7 to 16 μ (average 50 to 70 by 10 to 15 μ). The measurements of the Rumanian specimens were as follows: conidiophores 12 to 50 by 4 to 6 μ, 3- to 10-septate conidia 28 to 90 (average 40 to 50) by 10 to 15 μ; they thus approximate very closely to those given recently by Gulyás in Hungary for *A. tabacinum* (Ell. & Ev.) Gulyás [ibid., x, p. 212; cf. also xi, p. 77], with which *A. brassicae* var. *tabaci* is thought to be probably identical. The disease appeared immediately after transplanting and reached a climax early in August, after which sporadic infections occurred until September.

The elm disease caused by *Graphium ulmi* has been observed in the forests and avenues of Rumania for the last two years. It is widely distributed in the Bucharest district and probably occurs throughout the country.

Notes are also given on diseases of miscellaneous vegetable crops, vines, fruits, and ornamental plants.

Zpráva o škodlivých činitelích kulturních rostlin v Republice Československé v roce 1929–1930. [Report on the agencies injurious to cultivated plants in the Republic of Czecho-Slovakia in the year 1929–30.]—*Ochrana Rostlin*, xi, 1–2, pp. 1–88, 8 figs., 1931.

In this report [which is compiled on the same lines as that for the preceding year: *R.A.M.*, x, p. 75] A. Šeda states that meteorological conditions in the 1929–30 season led to severe attacks of brown and black rusts (*Puccinia dispersa* [*P. secalina*] and *P. graminis*) on rye, bunt (*Tilletia tritici*) [*T. caries*] on wheat, and crown and black rust (*P. lolii* and *P. graminis*) on oats. Rye, wheat, and barley also suffered fairly severely in some localities from *Ophiobolus herpotrichus* and *Erysiphe graminis*, and wheat from *Septoria tritici*.

Rambousek reports for the first time in Czecho-Slovakia the occurrence of beet mosaic [ibid., xi, p. 89], the symptoms of which are briefly described. Attempts to transmit this disease artificially failed. Cucumbers (*Cucumis sativus*) suffered heavily from seedling blight (*Pythium de Baryanum*), leaf and fruit blight (*Cladosporium cucumerinum*), and downy mildew (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*). Vine mosaic was again prominent in Mělník [ibid., x, p. 76].

Magerstein reports that plantations of basket willow [*Salix* spp.] were chiefly attacked by crown gall (*Bacillus* [*Bacterium*] *tumefaciens*) and root rot (*Rhizoctonia violacea*) [*Helicobasidium purpureum*]. *Rhytisma salicinum* was prevalent mainly on *S. purpurea*, and rust (*Melampsora* sp.) on *S. viminalis*.

The above are only a few of the numerous phytopathological records contained in this report.

Morwood (R. B.). **The work of the Pathological Branch.**—*Ann. Rept. Queensland Dept. of Agric. and Stock for the year 1930–1931*, pp. 47–48, 1931.

The following are among the items of interest in this report. Heart rot of bananas, a recently reported virus disease transmitted by the banana aphid [*Pentalonia nigronervosa*: *R.A.M.*, x, p. 472], has been found in various localities from Yeppoon to the southern border of the State. The symptoms are apparently masked during the cooler months of the year.

Papaws suffered severely from yellow crinkle, which is apparently due to a virus and spreads rapidly during the summer, eventually causing the rotting down of the stem.

A small localized occurrence of green rot of apricots (*Sclerotinia sclerotiorum* [ibid., x, p. 605] constitutes a new record for the State.

Diplodia macrospora has been found to be involved in the cob rot of maize in addition to *D. zeae* [ibid., x, pp. 223, 238; xi, p. 97].

Hector (G. P.). **Annual Report of the First Economic Botanist to the Goverment of Bengal for the year 1930–31.**—*Ann. Rept. Dept. of Agric. Bengal for the year 1930–31*, pp. 35–44, 1 map, 1931.

The following items of phytopathological interest occur in this

report. Good control of the *Phytophthora* disease of the betel vines [*Piper betle*] at the Dacca Farm was obtained by five applications of 1 per cent. resin-Bordeaux mixture, beginning on 12th May, 1930, combined with the use of healthy cuttings steeped for two minutes in 1 per cent. Bordeaux mixture [*R.A.M.*, x. pp. 223, 585]. Promising results have been given in several localities by soil sterilization with kerol (1 in 800) for the control of *S lerotium rolfsii* and *Rhizoctonia* on betel vines, against which spraying is ineffective. A species of *Phytophthora* caused a brown discoloration and wilting of *Hibiscus subdariffa* var. *ultissima* at the Dacca Farm. *H. cannabinus* and *Abutilon* sp. were attacked by *S. rolfsii*.

S. oryzae caused lodging of rice (early transplanted winter varieties) at Dacca and in Northern Bengal, up to 5 per cent. damage being recorded. In some cases the progress of the disease was arrested by draining off the standing water and letting the fields dry out. The following preventive measures have been recommended: burning of stubble in the fields after harvest [cf. below, p. 159], frequent ploughing, application of lime in small quantities, and cultivation of the apparently immune Departmental variety Dudshar.

At Krishnagar Farm the early sown tobacco beds were attacked during the cold weather by *Pythium de Baryanum*, and at Dacca *Asclepias* plants were infected by a species of *Fusarium* causing a blackening and wilting of the collar.

S. rolfsii was responsible for two diseases of ganja [*Cannabis sativa*], in one of which infection begins at the stem base while in the other the plant wilts from the top downwards; in both cases the plants were killed.

NARASIMHAN (M. J.). **Report of work done in the Mycological Section during 1929–30.**—*Admin. Rept. Agric. Dept. Mysore for the year 1929–30*, pp. 21–24, 1931.

Spraying for the control of areca [*Areca catechu*] koleroga (*Phytophthora*) [*arecae*] was carried out over an area of 5,172 acres in Mysore during the period under review, the total cost of the transactions amounting to about Rs. 17,231 [about £1,290]. Good results were again given by alum Bordeaux mixture [*R.A.M.*, viii, p. 704] over an area of some 259 acres; linseed oil at the rate of 2 fluid oz. per lb. of solid in the mixture acted as a very satisfactory adhesive, withstanding exposure to the August rainfall of 24 inches [ibid., xi, p. 41]. About 30 to 40 areca palms on the Marthur farm showed yellowing and dying of the tops from October, 1929, onwards, the causal organism apparently being a species of *Phytophthora* behaving similarly in culture to *P. arecae*. When paired cultures of the top rot *Phytophthora* were made with *P. arecae* and the *Phytophthora* from sandal [*Santalum album*], oospores developed in the sandal pair but not in the areca pair [ibid., ix. p. 684].

Smut [*Ustilago eleusinis*] of ragi [*Eleusine coracana*] was first observed about 1920 in the Dodballapur and Chikballapur districts, whence it has spread to a number of others, but only one report of serious damage has been received. Experiments in the

control of the disease in 1923–4 by steeping the seed-grain in various disinfectant solutions gave inconclusive results [ibid., vi, p. 78].

Of recent years the potato disease caused by *Alternaria solani* has assumed epidemic proportions. Good control has been given by the application of 0·5 or 1 per cent. Bordeaux with casein when the crop is 20 days old and again at six weeks or two months.

McDonald (J.). **Annual Report of the Senior Mycologist for 1930.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1930*, pp. 206–216, 1931.

Of nine collections of wheat stem rust (*Puccinia graminis tritici*) in 1930, eight were found to be one or other of the two physiologic forms, K1 [21] and K2 [17], already known to occur in Kenya [*R.A.M.*, x, pp. 508, 713], while the ninth, obtained from a plot of Reliance wheat at Njoro, proved to be a new form for the country. The Kanred and Reliance varieties, both of which are highly resistant to the K1 and K2 forms of *P. graminis*, were susceptible to the new form (K3).

A marked reduction of infection with the coffee berry disease caused by *Colletotrichum coffeanum* [*Glomerella cingulata*: ibid., x, p. 297] was noticed in two estates where the coffee bushes had been given heavy dressings of nitrogen, potash, phosphate, and farmyard manure, together with a small quantity of lime, fifteen months earlier. The fungus survives for 24 hours at 35° C., but failed to resume growth at normal temperatures after 27 days at 35°. At about 40° the organism was killed within three days. *Pestalozzia funerea* [ibid., vii, pp. 39, 426; viii, pp. 526, 814] occurred on the stem bark of a number of coffee seedlings, which did not appear, however, to be injured by the fungus.

The first record of *Diplodia zeae* on maize in Kenya was in 1929, and in 1930 it was again found in two localities but causing much less damage to the ears than that found in countries where the disease is serious.

Helminthosporium sativum [ibid., x, p. 373] was isolated from barley leaves at the Scott Agricultural Laboratories.

New plant disease records for Kenya in 1930 include circular [leaf] spot of apples (*Phyllosticta pirina*) [ibid., viii, p. 487]; rust (*Puccinia porri*) of garlic (*Allium sativum*) [ibid., x, p. 499]; red stripe disease of sugar-cane (*Phytomonas rubrilineans*) [ibid., x, p. 338; xi, p. 4]; and leaf spot [*Septoria cucurbitacearum*) of pumpkin (*Cucurbita pepo*) [ibid., iv, p. 467].

Plant pathology.—*Forty-third Ann. Rept. Arkansas Agric. Exper. Stat. for the fiscal year ending June 30, 1931* (*Bull.* 268), pp. 57–64, 1931.

This report contains, *inter alia*, the following items of interest. Species of *Alternaria* and *Helminthosporium* were again isolated by D. G. Carter and E. C. Tullis from Supreme Blue Rose, Fortuna, and Calora Jap rice kernels taken from plants affected by seedling blight [*R.A.M.*, x, p. 162]. The results of attempts to control stem rot of rice [*Sclerotium oryzae*] by burning the stubble before

ploughing showed an average of 17·1 per cent. stem rot on the burned-over plots compared with 40 and 42·7 per cent., respectively, on fertilized and unfertilized control plots.

Further experiments in the control of cotton wilt [*Fusarium vasinfectum*: ibid., x, p. 162] by V. H. Young. J. O. Ware, and G. Janssen showed that the incidence of infection is materially reduced by applications of kainit or muriate of potash, while mineral fertilizers not containing potash and also cotton-seed meal were ineffective. An extremely severe type of 'rust' or potash hunger was found to yield to applications of stable manure at the rate of 10 tons per acre accompanied by fairly liberal supplies of potash. It was found that wilt was not reduced on silt loam soil by treatment with potassium chloride, potassium sulphate, and kainit at a rate equivalent to 300 lb. per acre. On the 'rust sick' soil, however, the incidence of wilt was reduced from 30 per cent. to a trace, and that of rust from 80 to 5 per cent. by large applications of potassium chloride (320 and 640 lb. per acre). In the greenhouse the symptoms of cotton 'rust' were even more effectively eliminated by an application of manure at a rate equivalent to 12 tons per acre. V. H. Young found that the early development of cotton wilt is severely retarded by low soil temperatures, while possibly the high ones of late July and early August, coupled with low rainfall, may exert a similar but slighter influence.

Further studies were made by H. R. Rosen on fireblight of apples and pears (*Bacillus amylovorus*) [ibid., x, p. 111]; the disease was more destructive on the former host in Arkansas during 1930 than in any year for which records are available. In some orchards of susceptible varieties practically every blossom was killed, while the loss on these varieties as a whole is estimated at some 30 per cent. for the State. Pears, on the contrary, remained practically free from blight. An organism has several times been isolated from diseased pear material which shows marked cultural and physiological differences from the ordinary strains of *B. amylovorus* and, in fact, more closely resembles *B*[*acterium*] *nectarophilum* Doidge, *Pseudomonas prunicola* Wormald [ibid., xi, p. 58], and *Bacillus burkeri* Berridge [ibid., xi, p. 22]. There seems to be no correlation between the first blossom blight on the common susceptible apple varieties grown in the Ozarks of Arkansas and Missouri and the overwintering of the causal organism in diseased twigs and limbs. Good evidence is available, however, that the later form of twig blight, usually observed during the first half of July, may be traced to the previous year's blight in any apple orchard where the disease is prevalent.

Report of the Director for the year ending October 31, 1930.—*Connecticut Agric. Exper. Stat. Bull.* 322, pp. 111–150, 10 figs., 1931.

The following items of phytopathological interest occur in this report. Mature nuts from chestnut sprouts and seedlings were apparently more common in Connecticut during the period under review than in any year since the appearance of the blight [*Endothia parasitica*: *R.A.M.*, x, p. 696]. This does not, however,

imply resistance on the part of the tree, for all those individuals that were living when the first attacks of the fungus occurred are now dead. Sprouts arise from some of the stumps and succumb to the disease in four or five years, or seedlings may reach a height of 15 or 20 ft. before gradually contracting infection and dying.

A species of *Helminthosporium* has caused severe damage to lawns and golf courses, especially those recently sown with creeping bent [*Agrostis stolonifera*]. The symptoms are quite different from those of the common brown patch [*Corticium solani*: ibid., ix, p. 363], the grass presenting the appearance of having been matted down with oil, while the dead leaves show black spots. Spraying with Bordeaux mixture gave satisfactory control.

In the spring of 1930 apple scab [*Venturia inaequalis*] developed some five weeks ahead of its normal time, i.e., about 25th March, but owing to the drought infection was not so heavy as might have been expected. The ascogenous stage of the fungus was obtained in pure culture for the first time in the Station laboratory. A spray warning service is maintained by the County Farm Bureaux in co-operation with the Experiment Station. The best of the seven combined insecticides and fungicides tested mainly for spray injury (all quantities calculated for 100 galls. water) were: (1) 6 lb. dry lime-sulphur, 3 lb. lead arsenate; (2) sulfocide-scalecide applied at the rate of 1 gall. scalecide and 1½ galls. sulfocide at the pre-pink stage and ½ gall. sulfocide, 2 lb. lead arsenate, and 2 lb. kayso in summer; and (3) 10 lb. hydrated lime and 1 qt. fish-oil (except for scab on McIntosh). The following schedule was also satisfactory, except for russeting on Baldwin: delayed dormant, 8 lb. oxo-Bordeaux [ibid., x, p. 224], 5 galls. scalecide; pre-pink, 8 lb. oxo-Bordeaux; calyx, 6 lb. dry lime-sulphur; and summer, 8 lb. oxo-Bordeaux.

The attacks of the willow scab fungus [*Fusicladium saliciperdum*: ibid., ix, p. 500] appears to be diminishing in severity. In the village of Norfolk all the trees of *Salix alba* var. *vitellina* are dead with the exception of four sprayed in an experiment with Bordeaux mixture or lime-sulphur. The perfect stage of the fungus [*Venturia chlorospora*: ibid., x, p. 139] was obtained in culture for the first time; it has not yet been found in nature. The ascospores appear to differ from those described and figured by Aderhold.

During the summer of 1930, currant and gooseberry (*Ribes*) bushes were eradicated over 42,244 acres in 13 towns, an operation which is estimated to have protected some 14,500 acres of white pine [*Pinus strobus*] from blister rust [*Cronartium ribicola*: ibid., xi, p. 143]. Where the original eradication was carried out five or ten years ago, bushes have sprung up from the root-crowns or from seeds, necessitating fresh clearances.

Report of the California Agricultural Experiment Station from July 1, 1929, to June 30, 1930.—114 pp., 1 pl., 2 figs., 1931.

Many of the items of phytopathological interest in this report, which is compiled on the usual lines [*R.A.M.*, ix, p. 766], have

already been noticed from other sources, but the following may be mentioned. Ceresan was found to be less effective than copper carbonate in the control of wheat bunt [*Tilletia caries*].

Resistance to curly top of beets [ibid., ix, p. 758] has been found to be an inherent characteristic of many individual plants. In the case of the P–19 strain a consistent transmission of this character through five successive generations has been observed. When grown under exposure to infection, the P–19 strain gave a higher yield, a higher percentage of surviving beets, and a higher average size of roots than the commercial strain. The defects of this strain are low vigour, low vitality of seed, comparatively low sugar content, and an undesirable shape of root, but experiments are in progress to overcome these drawbacks by cross-pollination with certain strains combining some degree of resistance with other advantages, and promising results have already been obtained.

Evidence was obtained that the causal organism of beet mildew (*Peronospora schachtii*) [ibid., viii, p. 695] is carried in or on the seed.

Globe artichokes [*Cynara scolymus*] in various coastal districts suffered from a disease apparently due to a virus.

Individual bulbs among eight commercial varieties of onions were found to possess a certain degree of resistance to pink-root [*Phoma terrestris*: ibid., ix, p. 155]. A positive correlation was detected between soil infestation and severity of attack by this fungus, to which the Sweet Spanish variety seems to be slightly more resistant than other commercial sorts. Leeks (*Allium porrum*) are somewhat susceptible.

GRAM (E.). **Afsvampningsundersøgelser. IV. Udbytteforsøg med Kornarterne.** [Disinfection investigations. IV. Yield experiments with cereal species.]—*Tidsskr. for Planteavl*, xxxvii, 4, pp. 659–674, 1931. [English summary.]

Continuing his experiments in the disinfection of cereal seed-grain in Denmark [*R.A.M.*, viii, p. 710], the writer conducted further tests in 1929 and 1930 to ascertain the additional yield obtained by treatment on eight replicate plots, each trial being made at two experiment stations.

The results of the tests [which are tabulated and discussed] showed that wheat bunt (*Tilletia caries*) in the Standard variety is controllable by the following methods: sprinkling with germisan, tillantin C, sanagran VIII, danatin XI, and dahmit [ibid., xi, p. 117]; semi-dry use of sanagran VIII and dahmit; and dusting with ceresan. Infection in the untreated control plots ranged from 33 to 60 per cent., causing a reduction in the grain yield of 19 to 54 per cent. The average increase of grain resulting from the treatments was 10·7 to 11·3 hectokg. per hect.

The incidence of stem smut of Petkus rye (*Urocystis occulta*) was reduced from between 8 to 15 to 0·5 per cent. or under by the above-mentioned treatments, which largely prevented the reduction of yield due to the disease (13 per cent. loss of grain with 14 per cent. infection).

The fungicides used in these tests were also effective against stripe disease of barley (*Pleospora graminea*); the losses due to

this fungus, however, are generally very slight in Denmark, and they seldom exceed 0·5 to 0·7 per cent. of grain for each per cent. of infection.

Good control of loose smut of oats (*Ustilago avenae*) was given by sprinkling with formalin and by 30 minutes' immersion in 0·25 per cent. sanagran VIII, as well as in 0·5 per cent. dahmit or havre-fusariol (100 gm. corrosive sublimate and 250 gm. 40 per cent. formalin in 100 l. water) [ibid., ix, p. 639]. The increased yield due to these treatments was not appreciable, as the disease has become rare in Denmark.

BURTON (G. J. L.). **Annual Report of the Senior Plant Breeder for 1930.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1930*, pp. 228-243, 1931.

During the period under review considerable damage was caused by the root and foot rot diseases of wheat (*Fusarium* spp.), which had not hitherto been recorded in Kenya [*R.A.M.*, x, p. 513]. Glume blotch [*Septoria nodorum*] and black chaff [*Bacterium translucens* var. *undulosum*: ibid., x, p. 441] also occurred either alone or in conjunction with the *Fusarium* spp. Yellow rust [*Puccinia glumarum*: ibid., x, p. 301] was epidemic throughout the country, extending to below 6,000 ft.; only once before has this organism been found at such comparatively low altitudes. One hundred bags of seed of the yellow rust-resistant Njoro wheats, all of which are also resistant to black rust (*P. graminis*) [ibid., viii, p. 638] should be available for distribution in the coming season. The incidence of infection on these varieties at high altitudes was negligible even during the recent epidemic. Both humidity and temperature play an important part in the reaction of wheat in Kenya to yellow rust; a given variety, for instance, may be resistant at 18° and susceptible at 14°C., while another may be resistant at the latter temperature and susceptible below 10°. Among the progeny from the new crosses made at Njoro in 1931 it is hoped to obtain wheats of varying lengths of maturity resistant to both yellow and black rusts [see above, p. 159]. The black rust-resistant parents used are two of the new Njoro wheats and Kenya Standard, while Equator and a type selected out of Australian Florence are the yellow rust-resistant parents. A large number of wheats have been tested under controlled conditions at the Scott Agricultural Laboratories for resistance to black rust, with the result that, after discarding all those showing an insufficient degree of resistance, many have been retained for multiplication (40 or 50 strains of some families). Some crosses have recently been made with the object of producing early maturing wheat varieties resistant to both black and brown rust [*P. triticina*], and this work has already given promising results.

The root rots of maize due to *Fusarium* spp. and *Gibberella saubinetii* were found to be widespread in the Colony [ibid., xi, p. 39]. *G. saubinetii*, the causal organism of pink ear rot, seems to be specially implicated in the causation of rotting of seed in the ground, and in the dying-off of seedlings from 'blight'. These root rots are considered to be more injurious to maize in the Trans Nzoia than the white blight due to *Helminthosporium turcicum*

[ibid., x, p. 297], progress in the development of varieties resistant to which has been made.

VERWOERD (L.). **Die besmettingsvermoë van die Teleuto-stadium van Puccinia graminis Pers. in Suid-Afrika.** [The infective capacity of the teleuto stage of *Puccinia graminis* in South Africa.]—*Ann. Univ. Stellenbosch*, Ser. A, ix, 2, pp. 8, 1931. [English summary.]

Positive results were obtained, for the first time in South Africa, in the inoculation of the common barberry with teleutospores of the stem rusts of wheat, oats, and rye (*Puccinia graminis tritici, avenae*, and *secalis*). The teleutospores were frozen for 10 to 21 days, and then subjected to alternate wetting and drying every 4 or 5 days for 6 to 8 weeks [cf. *R.A.M.*, x, p. 366]. The inoculation tests were carried out in an incubation chamber, the temperature of which did not exceed 22° C.; 36 to 48 hours later the plants were transferred to the greenhouse. Previous failures are attributed to defective technique, especially as regards the physiological maturation of the teleutospores by artificial methods and the temperature relations at incubation and infection. The adverse effects of high temperatures were apparent in the summer of 1930, when no infection was secured with uredo- or teleutospores of *P. graminis*, whereas uredospores that developed on barley (volunteer) and *Hordeum murinum* in January, 1931, germinated freely and infected the plants.

The dimensions [which are tabulated] of the aecidiospores produced by the teleutospores were as follows: *P. graminis tritici* 19·46 ± 0·143 by 16·02 ± 0·014 μ; *P. graminis avenae* 18·60 ± 0·084 by 15·75 ± 0·076 μ; *P. graminis secalis* 16·87 ± 0·129 by 13·68 ± 0·081 μ. The best infections were obtained with the rust from rye and the poorest with that from oats.

Although these results were obtained under artificial conditions, the necessity of prohibiting barberry importation is evident, since in regions where low winter temperatures prevail, the teleutospores would undergo a natural process of maturation and might well cause the development of the alternate stage.

DE PAOLIS (C.). **Esperienze sopra l'azione che i prodotti di escrezione e del ricambio di 'Pythium' sp. hanno sulla germinazione del Grano.** [Experiments on the action of the excretory and metabolic products of '*Pythium*' sp. upon the germination of Wheat.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 138–143, 1 graph, 1931.

After referring to recent investigations into the effect exercised by certain soil fungi upon the growth of wheat [*R.A.M.*, vi, p. 220; ix, p. 581; x, p. 555] the author gives a detailed account of an experiment to test the effect on wheat of the metabolic products of the *Pythium* which severely attacked wheat near Padua in 1930 [ibid., x, p. 591], five pots each receiving an equal quantity of the filtered culture liquid, boiled ditto, filtered aqueous extract of the mycelium, boiled ditto, and, as a control, the same quantity of water. The same liquids were applied on two subsequent occasions. The pots were sown on 9th May and examined 7, 9, and 12 days later.

Seven days after sowing, pot I showed only about one-seventh as many germinated seeds as pot V (the control), where four seedlings had reached a height of 8 cm., while only one had attained a height of 6 cm. in the first pot. In the first pot the retardation in the germination was very striking, about 80 per cent. of the seed germinating between 16th and 21st May. Pot II showed about one-half as many seedlings as the control; two of them had reached a height of 7·5 cm. and two others of 7 cm. About 35 per cent. of the seed was delayed in germination to between 16th and 21st May. Pot III had about one quarter as many seedlings as the control, with one plant 7 cm. high and three 6 cm. high. About 60 per cent. of the germinations were delayed to between 16th and 21st May. In pot IV 40 per cent. of the seed had not yet germinated. The control pot (V) showed only 3 per cent. failure to germinate; the seedlings were well developed, about 15 of them having attained a height of 6 to 8 c.m. The differences between the plants in the various pots gradually disappeared.

The author concludes that products toxic to wheat accumulated in the culture liquid. These are probably partly excretory and partly obtainable also from the living mycelium. With one or more thermolabile substances, thermostable substances less toxic to wheat are also present. These toxic products retard germination for several days and slow down the rate of growth of the plants in the early stages of their development, thus favouring attacks by the *Pythium* itself as well as by other weak parasites.

TAPKE (V. F.). **Influence of humidity on floral infection of Wheat and Barley by loose smut.**—*Journ. Agric. Res.*, xliii, 6, pp. 503–516, 5 figs., 4 maps, 1931.

The detailed investigation of the relationship of relative atmospheric humidity to floral infection of wheat and barley with loose smut (*Ustilago tritici* and *U. nuda*, respectively) was undertaken following the observation that these smuts rarely occur in the parts of the United States in which relative humidity is low at the time of flowering of these cereals. Preliminary experiments showed that when the flowers of three club wheats (practically immune from loose smut in the eastern provinces) were inoculated with spores under humid conditions, the resulting seed produced from 91 to 96 per cent. smutted plants. In a further series of greenhouse tests, flowers of Little Club wheat inoculated with the smut were exposed for eight days to low (11 to 30 per cent.) and high (58 to 85 per cent.) humidity, with the result that the seed from the former produced 21·90 and that from the latter 93·96 per cent. smutted plants. In the low humidity series, the smut spores in the flowers only started to germinate on the third day from inoculation, and only a few spores with long germ-tubes were found after seven days; in the high humidity series, on the other hand, many spores were in the early stages of germination the day after inoculation, and on the third day about 90 per cent. had produced long germ-tubes. Comparable results were also obtained at Aberdeen, Idaho, where inoculations were made on flowers of Federation wheat and of Moultan and Hanna barleys in the field on desert and on irrigated land, respectively.

The authors consider that these results suggest a practical method for producing stocks of wheat and barley seed-grain free from loose smut by growing them in localities where atmospheric humidity is usually low during the blossoming period.

SIBILIA (C.). **Ricerche sulle ruggini dei cereali. III. La germinazione delle teleutospore di 'Puccinia coronifera', 'P. triticina' e 'P. graminis'.** [Researches on cereal rusts. III. The germination of the teleutospores of *Puccinia coronifera*, *P. triticina*, and *P. graminis*.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 115–128, 4 figs., 2 charts, 1931.

Further investigations [by a method which is described] into the germination of the spores of *Puccinia coronifera* [*P. lolii*], *P. triticina*, and *P. graminis* [*R.A.M.*, x, p. 171] demonstrated that under the climatic conditions that prevail in Italy these rusts germinate after a post-maturation period of about six months, and retain their germinability for about five months, though this period may be prolonged by submitting the teleutospores to artificial stimulation by radiation or immersion in various acids [loc. cit.]. The highest percentage of germination took place from the middle of January to the middle of April; *P. triticina* began and ceased to germinate earlier than *P. lolii* and *P. graminis*. The teleutospores of all three species, but especially those of *P. lolii* and *P. triticina*, readily tolerate high temperature (up to 65° C. for a few minutes) with no appreciable loss of germinative power.

DILLON WESTON (W. A. R.). **The effect of ultra-violet radiation on the urediniospores of some physiologic forms of P. graminis tritici.**—*Scient. Agric.*, xii, 2, pp. 81–87, 1931.

In continuation of his researches on the action of ultra-violet radiation on the viability of fungal spores [*R.A.M.*, x. p. 332], the author briefly describes experiments in which he tested this action on red, greyish-brown, orange, and white selections of uredospores of physiologic form 1 and orange spores of physiologic form 9 of *Puccinia graminis tritici* [ibid., x, p. 169] by exposing them for varying periods of time (from 1 to 90 minutes) to radiations from a 110 volts quartz mercury-vapour lamp. The results [which are presented in tabular form] showed that, generally speaking, the spores were killed more readily when irradiated in water than dry. The lighter coloured (white and orange) selections were more susceptible to the ultra-violet rays than the red and greyish-brown spores, and in parallel experiments, the spores of *Erysiphe graminis* exhibited a susceptibility to the rays comparable to that of the former. The inference drawn from this work is that the pigment in the walls of the darker spores protects the cytoplasm from the injurious action of the ultra-violet rays [cf. also, ibid., x, p. 779].

GASSNER (G.) & STRAIB (W.). **Untersuchungen zur Frage der biologischen Spezialisierung des Weizengelbrostes.** [Investigations on the question of biologic specialization in yellow rust of Wheat.]—*Der Züchter*, iii, 7, pp. 229–240, 2 figs., 1931.

During the period from the beginning of October, 1930, to the

middle of March, 1931, the writers tested 126 German original winter wheat selections for their reaction to 7 strains of yellow rust [*Puccinia glumarum*] and 24 summer wheat selections against 5 strains [*R.A.M.*, x, p. 713]. Subsequently a large number of other varieties were included in the trials, bringing the total to 1,358.

The results of the experiments [which are fully discussed and tabulated] showed that a number of winter wheats, especially of the Dickkopf group, are highly resistant to the Emersleben strain of *P. glumarum*. Of practical significance is the fact that nearly all the selections showing only slight susceptibility to the Schlanstedt I strain of *P. glumarum* are equally resistant to that from Emersleben. The other strains caused severe infection on most of the varieties used in the tests, though Carsten's Dickkopf V showed a fair degree of resistance to all but the Schlanstedt II strain (isolated in October, 1930). Holzapfel's Frühweizen proved highly resistant to the Schlandstedt II, Giessen (Wilhelm), Wetterau, and Hasenberg (July, 1930) strains but succumbed to the Schlanstedt I, Emersleben, Verrières, and Noissy-le-Roi strains. Very similar reactions were shown by the Dutch variety Mansholts van Hoekzomer, which remained, however, immune from the Verrières strain. Both the Weihenstephaner selections remained immune from the Schlanstedt II strain while showing varying degrees of susceptibility to the others. All the summer wheats were severely attacked by the Emersleben strain of yellow rust; Heine's Kolben and v. Rümker's early summer Dickkopf, especially the former, were immune from, or highly resistant to, all the other biologic forms used.

It is pointed out that external factors, especially temperature, exert a profound influence on the reaction of most German standard wheats to the various biotypes of *P. glumarum*, very few being immune under all conditions. Great care must be taken in future investigations on biologic specialization in the rusts to distinguish between the purely systematic aspect of this problem and its practical applications in plant breeding.

GASSNER (G.) & STRAIB (W.). **Die künstliche Rostinfektion von Freilandpflanzen und ihre Bedeutung für den Pflanzenzüchter.** [The artificial rust infection of field plants and its importance to the plant breeder.]—*Der Züchter*, iii, 7, pp. 240–243, 1 fig., 1931.

The writers have found that several weekly applications of spore suspensions of yellow rust [*Puccinia glumarum*: see preceding abstract] are essential to ensure the rapid and uniform distribution of the disease in the field when testing wheats for their resistance to the disease. For large plots a Holder battery should be used for spraying on the spores. The spores should be suspended in a 0·1 per cent. agar solution in preference to water, as this assists adhesion to the leaves. The applications are best carried out in quiet weather during the late afternoon, so that the spores may germinate in the dew of the following night. Satisfactory results have also been obtained by setting rusted plants in the plots at the rate of 10 per sq. m. It has often been found

advisable to inoculate highly susceptible varieties immediately adjoining the test selections rather than the latter themselves; infection then spreads rapidly and uniformly among the plots under observation. Among the winter wheats particularly suitable for this purpose may be mentioned Michigan Bronze, Gold Coin, Michigan Amber, Hopetown, Buffum, and Minhardi, while highly susceptible summer varieties are Oregon, Vehanti, Rosafé, and four varieties introduced from South America by the first-named writer, viz., Chacra II, Universal II, Fideos, and San Martin. The inoculation experiments should be conducted with that particular biologic form of the rust which predominates in the locality.

These methods have also been successfully applied during the last few years to the black and brown rusts of wheat [*P. graminis* and *P. triticina*], crown rust of oats [*P. lolii*], and dwarf rust of rye [*P. anomala*]. It should be noted, however, that autumn and early spring inoculations with *P. graminis* are ineffectual, the best results with this rust being secured in the early summer.

De Paolis (C.). **Esperienze sul trattamento del Grano con anticrittogamici a base di sali di mercurio.** [Experiments on the treatment of Wheat with fungicides containing a basis of mercury salts.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 158–164, 1931.

When wheat seedlings were grown in germinators, pots, and in the field from seed treated with 0·25 per cent. uspulun solution, 0·2 per cent. abavit B solution, the same fungicides used dry, mercuric chloride solution 1 in 1,000, and distilled water of neutral P_H value and tests made for the presence of mercury [cf. *R.A.M.*, x, p. 256; see also ibid., viii, p. 31] by a method [which is described] devised by Petri, it was found that the plants grown in the germinators from the seed treated with mercuric chloride or uspulun solution contained mercury in the roots and stem though its presence in the leaves was doubtful, while those treated with abavit solution had mercury in all three parts. The mercuric chloride markedly reduced the germinative energy and capacity of the seed, this effect being obvious throughout subsequent growth. All the other chemical solutions slightly reduced the germinative energy of the seed, but this effect was almost imperceptible when the uspulun or abavit was used dry.

On the 34th day after sowing the seedlings in pots (50 seeds per pot) the uspulun-treated seed, the mercuric chloride-treated seed, the water-treated seed, the abavit-treated seed, and seed given no treatment measured as a whole, respectively, 796·5, 197, 696·5, 529, and 781 cm. The results of the field tests corresponded with those of the pot tests, the mercuric chloride again giving very poorly developed plants. While the uspulun and abavit did not visibly stimulate growth, the weights of 1,000 seeds from the plants treated with uspulun solution, abavit solution, and distilled water (P_H 7) were, respectively, 36·338, 35·101, and 33·876 gm.

As even dipping the seed in plain water reduced its germinative energy, the author considers that dry seed treatments are always preferable to wet ones.

Schütz (W.). **Über die Einwirkung von Beizmitteln auf Keimung und Wachstum des Weizens.** [On the influence of disinfectants on the germination and growth of Wheat.]—*Bot. Arch.*, xxxiii, 1–2, pp. 199–256, 1 fig., 26 graphs, 1931. [English summary.]

A comprehensive and fully tabulated account is given of the author's experiments at Hohenheim, Germany, on the influence of various standard fungicides on the germination and growth of winter and summer wheat. The following preparations were used for winter wheat: 40 per cent. formaldehyde (0·1 per cent., 15 or 30 minutes' immersion); copper sulphate (0·5 per cent., 15 to 30 minutes' immersion); copper sulphate (0·5 per cent., sprinkling); germisan (0·125, 0·25, 0·5, and 1 per cent., 30 minutes); urania (Hohenheimer Beize) [*R.A.M.*, v, p. 114], the active principle of which is stated to be mercury rhodanide with a 6 per cent. mercury content (0·125, 0·25, 0·5, and 1 per cent., one hour); uspulun (0·5, 1, 1·5, and 2 per cent., 30 minutes), uspulun-universal (0·125, 0·25, 0·5, and 1 per cent., 30 minutes) [ibid., x, pp. 256, 742]; and abavit B and tillantin dusts, both at the rate of 0·3 gm. per 100 gm. of seed-grain.

In general, the effects of the treatments on the germinative capacity and energy of the seed-grain were favourable, especially where the regulation strengths were used. The beneficial effects were particularly noticeable in the increased development of the root system. This expansion was, however, nearly always accompanied by a reduction of haulm growth, except in the case of urania, which uniformly stimulated the development of both parts.

The summer wheat was treated with 0·25 per cent. solutions of germisan, urania, and uspulun-universal, uspulun (0·5 per cent.), and abavit B and tillantin dusts as above. In the second year of the tests (1928) uspulun-universal was used at a strength of 0·2 per cent. The summer wheat was found to react more strongly to fungicidal treatment than the winter variety (Dickkopf), especially as regards root growth. In a series of tests carried out at a low temperature (6° to 8°, mean 6·5° C.) the stimulatory effect of the fungicides was negligible.

Bodine (E. W.). **Double plate method used for culturing Tilletia levis.**—*Science*, N.S., lxxiv, 1918, p. 341, 1931.

A new procedure has been adopted for obtaining *Tilletia levis* [*T. foetens*] in pure cultures, the essential feature of which is the sowing of the smut spores on 3 per cent. non-nutrient agar in the top of a Petri dish, the bottom of which contains 2 per cent potato dextrose agar. The sporidia of the fungus, when ejected from the sterigmata, fall to the nutrient agar below, where they can be picked off singly or grown into multisporidial cultures free of contamination.

Henry (A. W.). **Occurrence and sporulation of Helminthosporium sativum P.K.B. in the soil.**—*Canadian Journ. of Res.*, v, 4, pp. 407–413, 1 fig., 1931.

In continuation of his study of the part played by *Helminthosporium sativum* in the foot and root rot of wheat in western

Canada [*R.A.M.*, x, p. 447], the author describes isolation experiments which showed that the spores of the fungus are very rare, if not entirely absent, in field soils. This fact would suggest that if *H. sativum* does live at all in such soils, it must be present largely in the form of mycelium, rendering its persistence there under adverse conditions very precarious. A somewhat expanded account is also given of experiments which showed that when traces of unsterilized soil were introduced into cultures of the fungus on sterilized soil, the sporulation of the organism was entirely suppressed, an effect which is believed to be attributable, in part at least, to the inhibiting action of the normal saprophytic micro-organisms of the soil thus introduced [loc. cit.].

MACINDOE (S. L.). **Stem rust of Oats. Observations at Glen Innes during the 1930–31 season.**—*Agric. Gaz. New South Wales*, xlii, 10, pp. 749–754, 1931.

Stem rust of oats [*Puccinia graminis avenae*] is stated to be of frequent occurrence and considerable severity in the cooler tableland districts of New South Wales; in 1930-1, in particular, climatic conditions at Glen Innes were very favourable to the rapid spread of this rust, a fact which allowed useful observations to be made on the relative resistance of a wide range of oat varieties to the disease, of which three of the five known Australian physiological forms, namely, forms 1, 2, and 7 [*R.A.M.*, ix, p. 439] were present. No variety was entirely free from the rust, but Birdwood (a local cross between Sunrise and Reid), Burke (a local selection from the American Kherson), Early Kherson, Iogold, Laggan, Richland, and Wisconsin Pedigree No. 7 were apparently extremely resistant. Thirteen further varieties [which are listed] exhibited light to moderate infection, while on the other side of the scale 77 varieties were extremely heavily infected; it is pointed out that this last group included such varieties as Red Rustproof and Rustless which are claimed by their producers to be resistant.

The paper terminates with a brief discussion of the problem of breeding oats for resistance to stem rust.

MAINS (E. B.). **Inheritance of resistance to rust, Puccinia sorghi, in Maize.**—*Journ. Agric. Res.*, xliii, 5, pp. 419–430, 4 figs., 1931.

This is a brief report of the work done since 1924 at La Fayette, Indiana, in the study of the inheritance to rust (*Puccinia sorghi*) [*P. maydis*] in pure lines of maize, a summarized account of the earlier results of which has already been noticed from another source [*R.A.M.*, vii, p. 440]. In addition to the resistant selections from Golden Glow 208–R, others resistant to forms 1 and 3 of the rust were obtained from Golden Glow 202–R. All the selections, however, were susceptible to form 4.

PEARSON (NORMA L.). **Parasitism of Gibberella saubinetii on Corn seedlings.**—*Journ. Agric. Res.*, xliii, 7, pp. 569–596, 10 figs., 1931.

This is a detailed and fully illustrated account of the author's study of the parasitism of *Gibberella saubinetii* [*R.A.M.*, x, p. 724]

on young seedlings of three inbred lines of maize, two of which are susceptible and the third is fairly resistant to the fungus. The results indicated that *G. saubinetii* usually enters the host tissues through the wounds in the cortex resulting from the emergence of adventitious roots or from the pulling apart of the epidermal cells in consequence of rapid growth. At first the fungus develops intercellularly, and though at a later stage the cells are invaded, the intercellular progress of the fungus usually continues two or three cells in advance of its intracellular growth. The cell wall is penetrated by a slender filament, and there was some indication that a chemical action is exerted by the fungus at the point of penetration. The unruptured coleorhiza is usually penetrated at points of its apical portion where plug-like structures are normally formed by the deposition of material between the epidermal cells, this material being apparently easily dissolved by the fungus.

Invasion of the host tissue is accompanied by an accumulation of dark-staining material in the cell-walls and intercellular spaces, extending considerably beyond the limits of the fungal advance. It is believed that this material may result from the action of enzymes secreted by the parasite either upon pectin-like substances and pentosans normally present in the cell walls or upon similar substances secreted into these regions by the cytoplasm. In areas extensively invaded by the fungus, the dark-staining material is somewhat decreased in quantity, being possibly used as food by the parasite. Occasionally, a swelling of the cell walls was also observed, especially in cells near the endodermis and in the hypodermal layers, and in the same regions callosities frequently form which may prevent penetration. In semi-resistant strains of maize the endodermis may form a partial, though not complete, barrier against the further penetration of the fungus.

Finally, in the cells bordering *G. saubinetii* lesions and natural or experimental wounds in the cortex of the mesocotyl, a displacement of the nucleus was observed towards the side of the cell nearest to the lesion, as well as alteration in the distribution and amount of the stainable portion of the cytoplasm.

MACKIE (W. W.). **A new disease of Maize and Beans.**—Abs. in *Phytopath.*, xxi, 10, pp. 996, 1931.

A new disease of maize and beans [*Phaseolus vulgaris*] caused by *Rhizoctonia batuticola* [*Macrophomina phaseoli*: *R.A.M.*, ix, pp. 82, 238; xi, p. 104], was observed in California during the summer of 1929. The fungus is readily recognizable by its dense, black sclerotia, 120 to 200 μ in diameter. In culture media about six days are required for the production of the sclerotia. They are found in the bean and maize roots and in the stems up to 10 or 12 inches above soil level; in both hosts they cluster about the vascular bundles and also occur in the pith. Wilt and premature ripening ensue, with a reduction in the size of the plant and the seed. All commercial bean varieties, except large Limas [? *P. lunatus*], and all subspecies of maize were attacked, but some indications of varietal resistance were noticed.

Reichert (I.) & Hellinger (E[sther]). **Citrus fruit diseases newly recorded in Palestine.**—*Hadar*, iv, 12, pp. 276–278, 3 figs., 1931.

During the season of 1930–1, a series of experiments in the control of citrus fruit rots, involving a thorough examination of over 31,700 fruits before and after six weeks' storage, revealed a number of diseases new to Palestine. *Dothiorella ribis* [*R.A.M.*, iv, p. 614; ix, p. 106] is responsible for a rot almost indistinguishable from that caused by *Diplodia* [*natalensis*], and in cultures on nutrient agar the mycelial growth of the two fungi is also similar, turning from dirty white to grey and eventually fumaceous to black. The pycnidia of *Dothiorella ribis* contain hyaline pycnospores measuring 12 to 20 by 3·5 to 6 μ (average 16 to 5 μ), while the ascospores of the perfect stage [*Botryosphaeria ribis*: ibid., iv, p. 178] were 15 to 19 by 5 to 8 μ. Inoculations on wounded and unwounded lemons resulted in the development of the rot within four days at 25° C. The decay originated as a watery yellow spot that changed to a colour between drab and light greyish-olive (Ridgway); later, parts of the fruit turned black. Infection progressed most rapidly along the central core to the stylar end and along the inner albedo and septa. This is stated to be the first record of *Dothiorella* rot on citrus fruits in a Mediterranean country, though Prof. Fawcett informed the writers that the fungus causes a gummosis of the branches in Italy, as well as in California. The disease does not appear to be common in Palestine, but control measures, where necessary, should be similar to those used against *Diplodia* [ibid., ix, p. 777].

A minor stem-end rot of oranges and lemons was caused by *Phomopsis* [(?) *citri*: ibid., x, p. 777], the early symptoms of which are similar to those of *D. natalensis*, except that the smell of the former organism is sweetish and not unpleasant, while that of the latter is irritating and pungent. Oranges attacked by *Phomopsis* develop a pliable, leathery, reddish-brown rot, generally proceeding from the stem-end; in lemons the decay is chocolate-brown, with a strong odour. The rot progresses most rapidly along the inner albedo, the central core, and the membranes of the pulp segments; where the joined septa meet the albedo, the decayed area is reddish-brown. Careful pruning and removal of dead wood, as in the case of trees infected by *D. natalensis*, should also prove beneficial against the *Phomopsis*.

The rot caused by *Sclerotinia sclerotiorum*, also observed for the first time on orange fruit in Palestine during 1930–1 [ibid., x, pp. 115, 307], originates as an orange-brown, firm, leathery spot with an indefinite, watery margin which rapidly advances until the whole fruit is involved. Masses of the white, matted, woolly mycelium formed on the surface of the fruit develop into black, hard, irregularly shaped sclerotia measuring from about 0·5 to several centimetres. Infection spreads rapidly by contact from one fruit to another. The fungus is thought to have been recently introduced into the citrus belt; it has a wide range of hosts in Palestine and may cause serious damage if not kept in check. Although infection takes place in the grove, the symptoms first appear during storage. Diseased fruits in the packing-house should

at once be removed and deeply buried or destroyed, the same treatment being also applied to cover crops or bananas grown in the same grove, from which infection is readily transmissible to citrus by various agents.

Fly speck (*Leptothyrium pomi*) [ibid., x, p. 24] causes no actual harm to the fruits but impairs their clean appearance.

PETRI (L.). **Variegatura infettiva delle foglie di 'Citrus vulgaris' Risso.** [Infectious mottling of the leaves of *Citrus vulgaris* Risso.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 105–114, 1 col. pl., 3 figs., 1931.

An account [illustrated by a useful coloured plate] is given of a marble-like mottling of the young leaves of bitter orange (*Citrus vulgaris* Bisso) [*C. bigaradia* or *C. aurantium*] observed in a grove near Messina, Sicily, in 1930. and in neighbouring groves a year later. The leaves were marked by white, pale green, or yellow irregular areas. In some leaves, especially near the apex of the leaf, the discoloured area extended across the blade, leaving narrow green bands along the midrib and the base of the secondary veins. In asymmetrical leaves only the less developed half showed the condition; these leaves were blistered and wilted.

Isolated leaves did not show the mottling, all the leaves on a twig or on several twigs being affected. Sweet orange [*C. sinensis*], lemon, and mandarin [*C. nobilis* var. *deliciosa*] remained unaffected, although the last two were in close proximity to affected sour oranges. Nearly all the mottled leaves were attacked by the black citrus aphid, *Toxoptera aurantii*.

Sections of affected leaves showed that the epidermal cells were normal, but the two-layered palisade consisted of shorter cells than those present in the green parts, and in these short cells the chloroplasts were poor in chlorophyll, the yellow areas being due to this deficiency; where the leaf was white the whole cytoplasm and the nucleus of the palisade cells had undergone a gummy degeneration. The spongy tissue underwent a similar degeneration, but only partially, and only the cells contiguous to the white palisade showed a clot of gum in the centre of the cellular cavity, while chloroplasts were present at the periphery. At scattered places in the leaf blade there was hypertrophy of the epidermal cells and hyperplasia of the underlying palisade, the cells of which were small and irregularly shaped, and only in a few was the nucleus recognizable. This increase in the palisade cells causes the upper surface of the leaf to protrude slightly, the area thus affected being of a bright malachite green. Excepting for *T. aurantii* the affected leaves show no signs of the presence of injurious organisms.

The author considers that the progressive spread of the disease indicates that it is infectious; the insect vector is probably *T. aurantii*. Further investigations into the etiology of the mottling are in progress.

RABINOVITZ-SERENI (D.). **Sulla presenza degli stomi sull' epidermide della pagina superiore delle foglie di varie specie dei 'Citrus'.** [On the presence of stomata on the upper

surface of the leaves of different *Citrus* species.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 164–170, 1 fig., 1931.

After referring to Petri's recent studies on the mode of infection of citrus by *Deuterophoma tracheiphila* [*R.A.M.*, x, p. 725] the author states that he has ascertained that the midrib of the upper surface of the leaves of lemon, grapefruit, sweet orange, mandarin, and bitter orange is covered with stomata along its entire length; they are fewest at the apex and gradually become more numerous as the base is approached. Lemon leaves average 90, grapefruit 55, sweet orange 49, mandarin 45, and bitter orange 32 stomata per sq. mm.

As the highly susceptible bitter orange has relatively few stomata on the leaf, the author considers that their number and size bear no relation to the susceptibility or resistance of the host to *D. tracheiphila*, which probably results from the chemical properties of the tissues.

Rabinovitz-Sereni (D.). **Perdita della facoltà germinativa delle spore di 'Deuterophoma tracheiphila' alla fine del periodo primaverile.** [Loss of the germinative capacity by the spores of *Deuterophoma tracheiphila* at the end of spring.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 154–157, 1931.

In studies (in hanging drop cultures) of the effect of various metallic salts and organic compounds upon the pycnospores of *Deuterophoma tracheiphila* [*R.A.M.*, x, p. 725] taken from subepidermal pycnidia on the young branches of bitter orange [see preceding abstracts] near Messina, the author observed that whereas in 0·1 per cent. solutions of potassium iodide and lead acetate the pycnospores became swollen and the number of them which germinated, as well as the length of the germ-tubes, was hardly less than in the controls, in those of other metallic salts such as copper sulphate, aluminium sulphate, and zinc sulphate, the spores scarcely swelled and germination was completely prevented. In cultures in organic compounds such as amygdalin, arbutin, salicin, methyl salicylate, and 1 per cent. gallic acid the number of spores that germinated and the length of the germ-tubes were invariably less than in the controls. In salicin and methyl salicylate the spores germinated rather more readily than in the other organic compounds.

During the experiments the air temperature was at first 18° to 20° C.; at this temperature the spores kept in distilled water for 30 hours all swelled, and 80 per cent. of them germinated, the germ-tubes attaining a length of 300 to 350 μ. When, however, the temperature abruptly rose to 30° only 10 per cent. of the spores swelled and very few germinated, the germ-tubes not exceeding 100 μ in length.

When kept at 15° to 16° for 30 hours none of the spores became swollen, while after 48 hours a few swelled slightly but none showed any sign of germinating; after 72 hours, two or three germinated.

These observations confirm those of Petri to the effect that during the Italian summer the pycnospores of *D. tracheiphila* not merely

become arrested in their development but also completely lose their germinative capacity [ibid., x, p. 593].

Rabinovitz-Sereni (D.). **Azione stimolante del biossido di carbonio sulla germinazione delle spore di 'Deuterophoma tracheiphila'.** [Stimulation of the germination of the spores of *Deuterophoma tracheiphila* by carbon dioxide.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 143–152, 3 graphs, 1931.

Exposure of the pycnospores of *Deuterophoma tracheiphila*, the cause of the 'mal secco' disease of citrus [see preceding abstracts], in hanging drop cultures to carbon dioxide for 30 hours [by a method which is described] markedly stimulated germination [cf. *R.A.M.*, vi, p. 413; viii, p. 163; x, p. 726], while the proportion of pycnospores which germinated when so exposed was invariably higher than among pycnospores on the same media in a normal atmosphere. The germ-tubes of the pycnospores so exposed showed a more vigorous development, and their average length was greater than in the controls.

Ruggieri (G.). **Sulla presunta influenza di certi terreni nel rendere resistanti al 'mal secco' le piante di Limone.** [On the presumed influence of certain soils in rendering Lemons resistant to 'mal secco'.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 170–171, 1931.

To test whether the absence of mal secco disease of lemons (*Deuterophoma tracheiphila*) [see preceding abstracts] from orchards on clay soil in the Alcantara valley [north-eastern Sicily] was due to the constitution of the soil inducing resistance or merely to the absence of the spores of the organism from this locality, the author grew bitter orange [*Citrus bigaradia* or *C. aurantium*] seedlings in pots of soil from this area (containing over 40 per cent. clay) the experiment being conducted in an infected area near Messina. The following spring the plants developed the disease contemporaneously with its first appearance in the Alcantara valley itself on soils ranging from sandy to muddy.

Passmore (F. R.). **Depreciation of prepared Copra due to moulds and insects.**—*Bull. Imper. Inst.*, xxix, 2, pp. 171–180, 1931.

In nearly all samples of copra examined in the course of investigations at the Stored Products Research Laboratories of the Imperial College of Science and Technology, London, some depreciation has been found to be caused by insects and moulds, the losses, however, seldom being sufficiently extensive to warrant biological investigation. Cases of inferior quality are almost always traceable to causes in the country of origin. The following moulds were isolated during a year's inspection of copra samples from widely different sources [cf. *R.A.M.*, x. p. 309]: *Aspergillus niger*, *A. flavus*, *A. tamarii*, *A. chevulieri* [ibid., ix, p. 177], *Rhizopus nigricans*, *Scopulariopsis* sp., *Syncephalastrum* (?) *cinereum*, *Penicillium candido-fulvum* Dierckx and other species of this genus, and *Mucor racemosus*.

HORGAN (E. S.). **The value of serological tests for the identification of Pseudomonas malvacearum.**—*Journ. of Bact.*, xxii, 4, pp. 287–293, 1931.

In connexion with an investigation on the epidemiology of black arm of cotton under field conditions [*R.A.M.*, x, p. 661], a serological study was carried out with various strains of *Pseudomonas* [*Bacterium*] *malvacearum* to determine the specificity of the agglutination test in the identification of this organism. Most of the strains were isolated from various sources in the Sudan and conformed in all cultural and morphological characters to the standard description of *Bact. malvacearum*. Great difficulty was experienced in many cases in the isolation of *Bact. malvacearum* on potato agar slopes, owing to the frequent close association with the black arm organism of a Gram-positive bacillus. Several other yellow and non-pigmented organisms of the *Pseudomonas* group are found in conjunction with *Bact. malvacearum* in the plant lesions, and four of these were isolated to ascertain their serological connexion with the black arm pathogen. Antisera were readily prepared by giving rabbits three or four weekly intravenous inoculations of a fairly thick suspension of the organism to be tested. Agglutination was carried out by the macroscopic method, the tubes being left for six hours in a water bath at 52° C. and then on the bench for 24 hours.

The results of the tests [which are tabulated and briefly discussed] showed that both floccular and granular or somatic agglutinins were present in all the sera prepared against four strains of *Bact. malvacearum*. The so-called 'rough' strain X5 (from Shambat lint) gave a perfect emulsion without a trace of the 'R' agglutinin, but a tendency to the formation of granular colonies was observed. Absorption was found to be completely reciprocal, any one strain removing all agglutinins from a given serum, both for itself and for all other strains. There would appear to be entire antigenic identity of all the Sudan and Egyptian strains of *Bact. malvacearum*, while a Trinidad strain also gave exactly similar agglutinin reactions. On the other hand, the E.F.S. strain of *Bact. malvacearum* gave anomalous results, indicating either a certain difference from the Sudan ones or an antigenic alteration as the result of repeated subculturing. No kind of antigenic relation was found to exist between *Bact. malvacearum* and the yellow pigmented organisms isolated from green bolls, or between the black arm pathogen and *P. hyacinthi*, a strain of *P. campestris* from Paine, and *Bacillus amylovorus*. On the other hand, some degree of cross-agglutination was observed between *Bact. malvacearum* and *P. campestris* E.F.S. strain [cf. ibid., vi, p. 651].

EZEKIEL (W. N.), NEAL (D. C.), DAWSON (P. R.), & REYNOLDS (E. B.). **Report of the fourth annual Cotton-root-rot conference.**—*Phytopath.*, xxi, 10, pp. 957–964, 1931.

Among other items of interest in this report on *Phymatotrichum omnivorum* in relation to cotton root rot the following may be mentioned [cf. *R.A.M.*, x, p. 241]. Physiologic forms differing widely in cultural characters were described by the first-named author and J. J. Taubenhaus. On potato-dextrose agar and

synthetic media, the strains provisionally assigned to form 1 produce an abundant buff-coloured growth and sclerotia, while those on form 4 develop more sparsely, remain white, and produce no sclerotia. Forms 2 and 3 possess intermediate characteristics.

S. E. Wolff and B. F. Dana reported as additions to the host list of *P. omnivorum* 32 non-cultivated and 35 ornamental species and varieties. Ezekiel and Taubenhaus stated that the guayule rubber plant (*Parthenium argentatum*) is susceptible to root rot. W. J. Bach found that the Champanel, Mustang, Black Spanish, and *Vitis chatini* grapes retained their resistance to root rot previously reported, the Dog Ridge, *V. salonis*, *V. constancia*, and *V berlandieri* varieties being also resistant. A high degree of resistance is still maintained by the sour orange [*Citrus aurantium*] rootstock for citrus. In tests of cover crops for use in citrus groves, *Crotalaria spectabilis*, *C. striata*, and cowpeas proved very susceptible, while *C. incana* and *Sesbania* were moderately resistant.

Notes are given on the toxicity to *P. omnivorum* of various disinfectants.

Neal (D. C.) & McLean (L. G.). **Viability of strand hyphae of the Cotton root-rot fungus.**—*Journ. Agric. Res.*, xliii, 6, pp. 499–502, 1 fig., 1931.

In continuation of the study of the mode of hibernation of the cotton root rot fungus (*Phymatotrichum omnivorum*) in Texas [*R.A.M.*, x, p. 186 and next abstracts], the authors state that the rhizomorphic mycelial strands of the organism, permeating the soil mass under spore mats collected from an active zone of infection in a lucerne field, proved to be viable after desiccation in the air at ordinary room temperature for six and a half months; the conidia on the mats failed, however, to germinate after that time. Further experiments showed that strands of the fungus at various depths in the soil of infected cotton fields were viable as late in the season as 10th December, but excavations during the three subsequent months failed to reveal any of these strands, a fact which tends to show that the organism does not overwinter in cotton fields in this form. The inference, therefore, is that the sclerotial stage is the main source of the perpetuation of the organism from year to year.

Neal (D. C.) & Ratliffe (G. T.). **Infection experiments with the Cotton root-rot fungus, Phymatotrichum omnivorum.**—*Journ. Agric. Res.*, xliii, 8, pp. 681–691, 3 figs., 1931.

Details are given of greenhouse and field experiments in 1928 and 1929 at San Antonio and Greenville, Texas, in the study of the pathogenicity to cotton of *Phymatotrichum omnivorum* [*R.A.M.*, x, p. 789, and preceding extracts], in which cotton plants of various ages were inoculated with pure cultures of the fungus grown from sclerotia found in the soil, sclerotia found in laboratory cultures [ibid., x, p. 662], and conidial mats. Successful infection of the plants was obtained and in some cases caused the death of the host. In pot experiments great variations were observed

in the minimum time required for initial infection. In field inoculations with infected roots there was some indication that the fungus was most virulent when on freshly infected roots, bearing a fine white mycelium. Attempts to transfer the disease to new areas by means of soil taken from a zone of active infection gave negative results, but it is pointed out that this failure may have been due to the dryness of the 1929 season, and possibly also to the fact that sclerotia were not present.

FAHMY (T.). **The genetics of resistance to the wilt disease of Cotton and its importance in selection.**—*Min. of Agric., Egypt, Tech. & Sci. Service* (*Plant Protect. Sect.*) *Bull.* 95, 30 pp., 10 pl., 13 graphs, 2 charts, 1931.

As regards their reaction to wilt disease (*Fusarium vasinfectum* var. *aegyptiacum*) [*R.A.M.*, x, p. 379], the cotton varieties grown in Egypt may be divided into two main groups, viz., immune (mainly Ashmouni types, grown chiefly in Upper Egypt), and non-immune, e.g., Sakel, cultivated exclusively in Lower Egypt. The results [which are tabulated] of greenhouse tests showed that susceptibility in the Sakel types ranges from 5·9 to 94·2 per cent., the corresponding figures for St. Kitts, St. Vincent, and Pima 5/28 being 94·5, 73·4, and 100 per cent., respectively. A number of American varieties proved immune from wilt in Egypt, including Dixie Triumph, Webber, Express 95, Toole, Cleveland, Lightning Express, and Mexican Big Boll, as also did the Indian *Gossypium hirsutum* var. Nauk., Dharwar II No. 1, Buri No. 3, Codag 1, and Jayawant.

Susceptibility to wilt is an inherited character. In the F_2 generation of genotypic immune and susceptible parents segregation occurs, giving three types: immune (75 per cent.), resistant (15 per cent.), and susceptible (10 per cent.). The immunes may breed true or segregate. In the resistant group segregation occurs, giving either two (immune and resistant) or all three types. It was not possible to follow the susceptible group in the progenies of the above-mentioned cross, since all died at the seedling stage, but in the case of Domains Sakel plants reviving after 'partial' death in the infected field, segregation may take place in the progenies notwithstanding typical symptoms of wilt in the mother plant. It is evident that the immune parent in a susceptible-immune cross can transmit an element of resistance to some of its susceptible progeny which becomes manifest in the F_2 generation by an increase in the length of the incubation period of the fungus. The same thing occurs in a heterozygous susceptible cross. This resistance to invasion on the part of the host is important, since plants with a long incubation period yield a higher percentage of immune progenies than those which rapidly succumb to infection.

No complete correlation was found between length of staple in Domains Sakel and susceptibility. Plants with short staple lint may produce offspring of equal susceptibility with those raised from long staple parents. Resistant plants, as a whole, are of lower lint quality, but may include a few individuals of fair staple length that might prove useful in the further selection of immune

types. More satisfactory results may be secured in a shorter time, however, by testing the susceptibility of related families already selected for lint quality independent of reaction to wilt, and subsequently isolating a desirable type immune from wilt and of superior quality. In this connexion a brief account is given of two promising selections, Sakha 4 and Myco 5.

PETCH (T.). **Notes on entomogenous fungi.**—*Trans. Brit. Mycol. Soc.*, xvi, 1, pp. 55–75, 4 figs., 1931.

In this paper the author gives taxonomic notes [including diagnoses in English of one new genus (*Ophiocordyceps*) and several new species] on the following entomogenous fungi: *Beauveria laxa* n.sp. on larvae of a lepidopteron, of *Tortrix* sp., of the coco-nut moth *Brachartona catoxantha* [type specimen of *Botrytis necans* Massee: *R.A.M.*, iii, p. 569], and on spiders, lepidopterous cocoons, and tineid cases; *Beauveria bassiana* on caterpillars, beetles, *Astycus* sp., *Cyclopeltella siccifolia*, centipedes, millipedes, the larvae of a longicorn, and *Haplocerambyx spinicornis*; *B. densa* on a leafhopper, various beetles, and lepidopterous cocoons; *Rhinotrichum album*, which has recently been found to be the same as *Gonatorrhodiella coccorum* [ibid., v, p. 97], on *Lecanium*, *Aleyrodes*, aphids, and leaf-hoppers; *Volutella epicoccum* [ibid., vi, p. 552] on scale insects on *Cinnamomum ovalifolium*; *Hypocrella schizostachyi* on *Lecanium bambusicola*; *Isaria abietina* (which is renamed *Hirsutella abietina* comb. nov.) on a sugar-cane hopper (*Pyrilla pusana*); *Oospora insectorum* n.sp. on a spider, (?) *Aleyrodes*, and various pupae; *O. subfasciculata* n.sp. on a millipede and on a pupa; *Tilachlidium larvarum* on the larvae of a micro-lepidopteron; *Acremonium griseum* on spiders, a fly (*Mydaea* sp.), and a lepidopterous cocoon; *Botrytis eriophyes*, which is now renamed *Cephalosporium* (*Acrostalagmus*) *eriophytis*, on *Eriophyes ribis*; *Isaria cicadae* on locusts; *Metarrhizium anisopliae*, the green muscardine fungus [ibid., ix, p. 717], on various insects; *M. album* n.sp. on *Tettigoniella spectra* on rice; *Cephalosporium* (*Acrostalagmus*) *aphidicola* n.sp. on aphids; *C. crassum* n.sp. on *Pentalonia nigronervosa*; *Sterigmatocystis ferruginea* on the pupa of *Attacus ricini*; *S. fulva* on the silkworm (*Bombyx mori*); *Penicillium brevicaule* on dead insects; and *Cordyceps sherringii* Massee on an ant (considered to be an immature *C. lloydii*).

Four species of *Cordyceps*, namely, *C. blattae*, *C. unilateralis*, *C. peltata*, and *C. rhizoidea* are grouped into a new genus, *Ophiocordyceps*, and are renamed *O. blattae*, *O. unilateralis*, *O. peltata*, and *O. rhizoidea*, with the first named as the type species. *Beauveria peteloti* Vincens is stated to consist of a *Sporotrichum* growing on the clavae of *Hirsutella saussurei*.

TOUMANOFF (C.). **Action des champignons entomophytes sur les abeilles.** [The action of entomogenous fungi on bees.]—*Ann. de Parasitol. Humaine et Comp.*, ix, 5, pp. 462–482, 6 graphs, 1931.

After a brief review of the results obtained by previous investigators in the experimental infection of bees with entomogenous fungi [*R.A.M.*, iii, p. 336; ix, p. 591], the author gives details of

his own work with *Aspergillus flavus*, *Isaria farinosa*, and *Beauveria bassiana*. Of these organisms *A. flavus* alone proved to be constantly and highly virulent to the bees, killing the experimental populations within five days, while control insects under similar conditions lived over a fortnight. High individual resistance to the fungus was, however, observed among the bees, and generalized mycosis caused by it was only observed in two cases, the infection in the still living insect being usually localized to the digestive tract. It is stated that generalized infection caused by *A. flavus*, as seen in the two exceptional cases, had not been previously recorded in the bee. *I. farinosa* and *B. bassiana* were weakly and only occasionally pathogenic. Attempts to infect the larvae by inoculating the cells of the honeycombs with spore suspensions of all the three fungi have so far consistently given negative results.

The investigation also indicated that the lethal action of the organism on the bees is almost exclusively due to the toxins secreted by them or liberated by the action of the gastric juices on the mycelium, a suggestion which is confirmed by the fact that culture filtrates of *A. flavus* and *B. bassiana* were very toxic to the bees fed upon them; the symptoms brought about by this means or by experimental infection were similar to those observed in insects suffering from naturally contracted parasitic diseases.

SIGOT (A.). **Une Chytridiacée nouvelle, parasite des œufs de Cyclops: Blastulidiopsis chattoni n.g., n.sp.** [A new Chytridiaceae, parasitic on *Cyclops* eggs: *Blastulidiopsis chattoni* n.g., n.sp.]—*Comptes rendus Soc. de Biol.*, cviii, 27, pp. 34–37, 1 fig., 1931.

In 1929 and 1930 *Cyclops* eggs laid in a pond in the garden of the Strasburg Institute of Zoology and General Biology were found to be infected by a parasite causing protuberances and general enlargement. Stained sections of infected eggs appeared to contain circular or elliptical blastules of variable dimensions, the wall of which enclosed a large number of regularly distributed nuclei furnished with a caryosome. In reality, however, these pseudoblastules are connected and merely constitute swellings or diverticula of a single cavity. At maturity a large number of biflagellate zoospores are discharged. The flagella are inserted laterally into the zoospores, one moving forwards and the other backwards; they are unusually long (15 to 20 μ), the length of the spore being only 6 to 8 μ.

On encountering a healthy egg, the zoospore adheres to the surface, discards its flagella, and penetrates the egg by means of a kind of mycelial tube. The nuclei multiply and divide, while the mycelial hypha increases in diameter, branches, swells in places, and forms vacuoles which expand, converge, extend into the ramifications of the plasmodium, and ultimately constitute the cavity of the large circumvolute chamber. Sporulation occurs when the parasite has completely exhausted the protoplasm of the egg and filled the space enclosed by the ovular membrane. The period of development of the parasite in the egg, from the entry of the zoospore to sporulation, corresponds approximately to that of

the *Cyclops* egg. The regular recurrence of the parasite in the spring (end of February and March) implies the existence of resting forms and probably of heterothallism.

The organism is referred to the Chytridiaceae under the name of *Blastulidiopsis chattoni* n.g., n.sp., its analogies with other genera of this family being briefly discussed.

MACY (H.), COMBS (W. B.), & MORRISON (H. B.). **The churn as a source of molds in butter.**—*Journ. Dairy Sci.*, xiv, 5, pp. 398–403, 1931.

Two churns from commercial creameries in Minnesota were examined for the presence of moulds, which were most abundant in one that had given considerable trouble as a source of mouldy butter. Moulds of the following genera occurred in both: *Mucor*, *Penicillium*, *Aspergillus*, *Alternaria*, and *Hormodendrum*, while the more contaminated one also contained species of *Monilia*, *Sporotrichum*, *Acremoniella*, *Botrytis*, *Phoma*, *Spicaria*, *Gliocladium*, *Oospora*, *Spondylocladium*, *Cephalosporium*, *Chaetomium*, *Sordaria*, and *Tilachlidium* [cf. *R.A.M.*, x, p. 242].

MILOCHEVITCH (S.). **Sur un cas de trichophytie produit par une espèce nouvelle de Trichophyton, T. langeroni n. sp.** [On a case of trichophytosis caused by a new species of *Trichophyton*, *T. langeroni* n. sp.]—*Ann. de Parasitol. Humaine et Comp.*, ix, 5, pp. 456–461, 1 pl., 2 figs., 1931.

This is a brief morphological and cultural account of a species of *Trichophyton*, considered to be new to science, which was isolated from a ringworm on the head of a child in Belgrade. The fungus, for which the name *T. langeroni* is suggested, was grown on the whole series of natural and artificial media recommended by Langeron and Milochevitch [*R.A.M.*, x, p. 242], but failed in every case to produce fructifications other than arthrospores and terminal or intercalar chlamydospores. On agar media it formed typical faviform colonies, with all the morphological details characterizing them. The organism is believed to represent a new section, *microides*, of the genus *Trichophyton*, with characters belonging both to the endothrix and megaspore sections. Inoculations into the guinea-pig gave negative results.

GOUZARTCHIK-GLARNER (Mme V.). **Étude biologique d'une souche d'Aspergillus fumigatus isolée des crachats d'un malade.** [A biological study of a strain of *Aspergillus fumigatus* isolated from the sputum of a patient.]—*Comptes rendus Soc. de Biol.*, cviii, 29, pp. 374–376, 1931.

Spore suspensions in physiological serum of *Aspergillus fumigatus*, isolated from sputum of a male patient [*R.A.M.*, x, p. 28], caused severe internal disturbances on inoculation into rabbits and guinea-pigs, the kidneys being chiefly affected while the lungs and liver were also involved. A limited degree of success was achieved in reducing these symptoms by intratracheal injections of the antivirus of *Aspergillus* into the guinea-pigs previous to inoculation.

MARCHAL (E.). **A propos de la 'brûlure' du Lin.** [On 'fire' of Flax.]—2 pp., Pamphlet of Congrès National des Sciences. [Belgium, 1931.]

In the spring of 1930 the author examined flax from the vicinity of Courtrai which showed typical symptoms of 'fire', usually associated with *Asterocystis radicis* and *Pythium megalacanthum* [*R.A.M.*, x, p. 731]; the end of the stem was flaccid, the leaves, especially the lower ones, were yellow, and the main roots showed vitreous ramifications and were easily detached.

An examination of fifty plants showed the constant presence at the base of the root hairs, in the cells of the piliferous layer, and in the underlying parenchyma, of the resting spores of *A. radicis*. Few sporangia were present as the fungus had already ceased very active reproduction. On no plant was *P. megalacanthum* present, and cultures made from the affected roots did not yield this or any other organism that could possibly cause the disease.

On further flax plants affected by fire from three other localities the author also found *A. radicis* but no *P. megalacanthum*. He therefore concludes that in Flanders the disease is associated ordinarily with the former fungus.

BURNETT (L. C.) & REDDY (C. S.). **Seed-treatment and date-of-sowing experiments with six varieties of Flax.**—*Phytopath.*, xxi, 10, pp. 985–989, 1931.

Experiments conducted with the chief flax varieties resistant to wilt [*Fusarium lini*: *R.A.M.*, x, p. 384] at four places in Iowa in 1930 showed that Bison seed of high vitality treated with ceresan (2 oz. per bushel) produced percentage stands of 42·6 to 63·6 compared with 14·9 to 53·4 for untreated seed of the same lot. This preparation increased the yields of Bison flax by 26·5 per cent. in 26 replications, and those of five other varieties, viz., N[orth] D[akota] R[esistant] 114, Redwing, Linota, Buda, and Rio (2 replications each) by percentages ranging from 12·6 to 44·5.

ZAPROMETOFF (N. G.). **Болезни новых лубянных культур в Ташкентском районе.** [Diseases of new bast-producing cultures in the region of Tashkent.]—*За новое Волокно.* [*In Furtherance of the New Fibre*], Moscow, *1931*, 8–9, pp. 60–65, 1931.

In this preliminary report brief accounts [together with some notes of local interest] are given of the chief parasitic and physiological diseases which were found in 1930 attacking newly introduced fibre- and bast-producing crops in Russian Central Asia, with particular reference to those grown in the district of Tashkent, among which the following may be mentioned.

Kendir fibre (*Apocynum sibiricum*) [*A. venetum*] was severely attacked by rust (*Melampsora apocyni*) [*R.A.M.*, x, p. 435], the incidence of which, in some localities, was over 77 per cent.; the disease was particularly severe on plants left for seed and on young transplants from under glass. This host also suffered heavily from a wilt caused by a species of *Fusarium* which attacks the root system, frequently in association with an undetermined eelworm. On the roots and collar the organism forms a whitish-grey efflorescence, under which the wood tissues are blackened and the cortex rots.

In pure culture on rice and acid agar the fungus produced oblong-oval, occasionally bean-shaped, continuous or two-celled microconidia, 8 to 15 μ long; hyaline, slightly bent, two- or three-septate macroconidia, 16 to 32 μ long; and white, warty sclerotia. The substratum was white at first, later pale purple. In one locality the stems of kendir fibre plants were found to bear slightly sunken, irregular or elongated, brown lesions, bearing black, globose or oval pycnidia (immature), 450 to 500 μ in diameter, of a fungus of the *Phoma* type.

Indian hemp (*Hibiscus cannabinus*) was attacked by powdery mildew (*Leveillula* [*Oidiopsis*] *taurica*) [ibid., ix, p. 715], this being stated to be the first record of the fungus on this host; by *Moniliopsis aderholdi*, which caused a root rot of young seedlings, and by wilt (*Fusarium vasinfectum*), which in 1930 was of no consequence. *Abutilon avicennae* suffered from wilt caused by unidentified, soil-inhabiting species of *Fusarium*, and from sooty mould caused by *Cladosporium herbarum* and *Macrosporium abutilonis* [ibid., vii, p. 763]. In addition to wilt (*F. vasinfectum*) and seedling root rot (*M. aderholdi*) *H. esculentus* was attacked by powdery mildew (*Oidium abelmoschii*) [ibid., vi, p. 321]. Jute (*Corchorus capsularis*) in several localities suffered severely from attacks by *Epicoccum neglectum*, which caused the formation, first on the leaves, and then on the petioles and green portions of the stems, of rounded, polygonal, brown spots with black margins, from 0·25 to 0·75 cm. in diameter.

Ocfemia (G. O.). **The bunchy-top of Abacá and its control.**—*Philipp. Agric.*, xx, 5, pp. 328–340, 6 figs., 1931.

In this paper the author presents the results so far obtained in his investigations, which have been in progress since 1925 and have been noticed from time to time in this *Review*, on the bunchy top disease of abacá [*Musa textilis*] in the Philippines and its control [*R.A.M.*, xi, p. 46].

Dufrénoy (J.). **Mosaïque des Tulipes.** [Tulip mosaic.]—*Comptes rendus Soc. de Biol.*, cviii, 27, pp. 51–53, 2 figs., 1931.

A mosaic affection similar to 'breaking' of tulips in England [*R.A.M.*, x, p. 599] has been observed in France among bulbs imported from Holland. Severely diseased plants are stunted and partially or entirely fail to flower; the leaves are concrescent and show elongated discoloured blotches; and the cytoplasm, hollowed by numerous small vacuoles, presents a spongy aspect and contains an abundance of lipoids near the nucleus. Affected plants die prematurely. Normally the epidermal cells of red flowering varieties are almost entirely filled by a large central vacuole containing a red solution of anthocyanin, while in the mottled areas of diseased flowers some of the small, spherical vacuoles contain this substance and in others the solution is uncoloured.

Zeller (S. M.) & Deremiah (J. W.). **An anthracnose of Ledum caused by a species of Elsinoë.**—*Phytopath.*, xxi, 10, pp. 965–973, 3 figs., 1931.

Particulars are given of an anthracnose of the evergreen shrubs,

Ledum glandulosum and *L. groenlandicum*, in the United States. The leaves develop greyish-white lesions with reddish-brown borders, often surrounded by purplish margins, while the branches, flower pedicels, calyx, and capsules may also be attacked. The causal organism, to which the name *Elsinoë ledi* (Peck) Zeller n. comb., is given (with an English diagnosis), is characterized by solitary or gregarious pulvinate stromata which occur near the centre of the lesion, and are circular or irregular, black, and 45 to 200 μ in diameter. A pseudoparenchymatous ascocarp with a hyaline interior and brownish surface arises beneath and ruptures the ectostroma; it is 70 to 19 μ broad and 28 to 110 μ high. The scattered loculi contain each a single subspherical ascus, 17 to 25 by 21 to 28 μ, with 1 to 8 (mostly 4 or 8) ellipsoid to fusoid, generally unilateral, triseptate (rarely uni- or biseptate) ascospores measuring 12 to 17·7 by 5 to 6·5 μ.

CUNNINGHAM (G. H.). **Fireblight and its control.**—*New Zealand Journ. of Agric.*, xliii, 2, pp. 111–118, 3 figs., 1 map, 1931.

In giving a brief account of the spread and economic importance of fireblight (*Bacillus amylovorus*) of pomaceous trees in New Zealand [*R.A.M.*, ii, p. 273; x, p. 318], the author states that when it first appeared there in 1919, it destroyed in a single season many acres of pear trees, apparently threatening the whole future of the fruit industry. Within a few seasons from the initial outbreak, however, the damage caused by it was reduced to the killing of occasional branches of pear trees and the destruction of a proportion of blossom spurs on apples and pears. The same sequence of events was again repeated when the disease made its first, epidemic appearance in 1927 in the districts of Wanganui, Hawke's Bay, Manawatu, and Wairarapa. At the present time, fireblight is regarded as a serious disease of the pear only in those localities where it has not yet appeared, since under normal conditions in the already infected areas it only takes a small annual toll of blossoms, although occasionally some branches may be killed, and in extreme cases a whole tree may be destroyed. On apple trees the disease seldom does serious damage.

In discussing control measures it is pointed out that the problem, which theoretically could find an easy solution by the elimination from the orchards of hold-over cankers, is complicated by the fact that in some regions the highly susceptible hawthorn [*Crataegus*] is used as a cattle shelter hedge, this rendering the elimination of the fungus a practical impossibility. To meet this difficulty an Act was passed in 1922 [ibid., ii, p. 144] which has made possible the removal of hawthorn hedges in the vicinity of commercial orchards, a step which, in conjunction with the rigorous practice of excising all small cankers and sterilizing larger ones, has led to a practical control of the disease in most commercial fruit-growing areas. The method found most effective is the complete removal of all infected laterals, fruit spurs, or small branches, the cut being made some little distance below the visible point of infection. On larger branches the cankers may be excised to a depth of at least half an inch below the surface, the resulting wound being sterilized by swabbing it with a solution made up of 1 gm. mercuric chloride,

15 c.c. concentrated hydrochloric acid, and 1,000 c.c. water; as soon as the wound has dried up it should be painted with coal-tar and kept under observation for a month or so, when the treatment should be repeated if the cankers show any signs of further spread. [This paper is also printed as *New Zealand Dept. of Agric. Bull.* 153, 1931.]

DULLUM (N.). **Forsøg med Kombination af Svovlkalk- og Bordeaux-vædskesprøjtninger til Æbletræer.** [Experiments with lime-sulphur and Bordeaux mixture sprays on Apple trees.]—*Tidsskr. for Planteavl*, xxxvii, 4, pp. 641–658, 13 figs., 1931. [English summary.]

The following spray schedules were used against apple scab (*Venturia*) [*inaequalis*] at the Danish State Experiment Station during 1929 [cf. *R.A.M.*, ix, p. 113]: (*a*) four applications of Bordeaux mixture (½ kg. copper sulphate and 1 kg. burnt lime per 100 l. water); (*b*) one application of lime-sulphur (2 kg. lime-sulphur per 100 l. water) followed by three of Bordeaux mixture; (*c*) one of Bordeaux mixture followed by one of lime-sulphur and two of Bordeaux mixture; (*d*) in 1930 two applications of lime-sulphur followed by two of Bordeaux mixture were given instead of Bordeaux mixture only as in (*a*).

In 1929 the percentages of perfectly clean fruit obtained under schedules (*a*), (*b*), and (*c*) were 14·9, 28·8, and 61·4 per cent., respectively, the corresponding figures for spray injury being 19·6, 14·3, and 1·8, respectively. In 1930 the percentages of perfect fruit were as follows: (*b*) 56, (*c*) 53·2, and (*d*) 68·9, the figures for spray injury being 2·7, 0·4, and 0·4, respectively. The fact that spray injury from the (*b*) and (*c*) schedules was more severe in 1929 than in 1930 is attributed to the unfavourable weather conditions (damp and cold) before the second application in the former season. At this critical period the fruit is highly sensitive to spray injury, which may cause considerable damage to certain varieties. In most cases this form of injury may be reduced within reasonable limits by the substitution of lime-sulphur for Bordeaux mixture in the two first summer applications.

BIRMINGHAM (W. A.) & BROADFOOT (H.). **Black spot or scab of Apple. Experiments for its control in New South Wales. Part II. The Batlow experiments.**—*Agric. Gaz. New South Wales*, xlii, 9, pp. 721–729, 5 figs., 1931.

In continuation of the senior author's account of the experiments so far made on the control of black spot or scab [*Venturia inaequalis*] in New South Wales [*R.A.M.*, xi, p. 114], this paper briefly reviews the results obtained in the district of Batlow during the period from 1925 to 1930. Of the seven distinct spray programmes tested during that time, the disease was best controlled by applications of Bordeaux mixture throughout the season, which, however, entail some risks of very severe russeting in certain years. The schedule recommended on the basis of the work, as having reduced black spot infection in the orchards to an average of 1·4 per cent. for the five year period, as against 55·2 to 63·5 per cent. in the controls, without risk of russeting, is 6–4–40 Bordeaux mixture

at the 'burst spur' stage, 1 in 14 lime-sulphur at the 'pink' stage, and 1 in 35 lime-sulphur at the 'calyx' stage and subsequently as required.

FISHER (D. F.) & REEVES (E. L.). **A Cytospora canker of Apple trees.**—*Journ. Agric. Res.*, xliii, 5, pp. 431–438, 5 figs., 1931.

A brief account is given of a serious outbreak in 1928 of cankers on a number of varieties of apple trees at Orondo, Washington, and of an even more severe one in 1929 in British Columbia, caused by apparently the same undetermined species of *Cytospora*. Experiments to test the efficacy of fungicidal dressings applied to the wounds resulting from the surgical treatment of the cankers showed that the best results were obtained with asphaltum paint. A paint prepared from commercial Bordeaux mixture powder and linseed oil (with about 10 per cent. metallic copper content) produced toxic effects on the foliage. Alcoholic solutions of zinc chloride as recommended against pear blight [*Bacillus amylovorus*: *R.A.M.*, ix, p. 792] and a mixture of sodium arsenite and linseed oil produced injurious effects in the wood and bark tissues and in the foliage in every case.

Artificial inoculations with the organism gave negative results on sound apple wood and also on wood injured but not killed by winter frosts. It is believed, therefore, that the fungus is not normally parasitic on apple wood, and that the epidemics observed were due to the weakened, devitalized condition of the trees growing on unsuitable soil, a view which is supported by the fact that improvement in their health brought about by cultural methods and manuring resulted in the cessation of the enlargement of the cankers and in the complete healing of the affected areas.

Control of rust in Peaches.—*Fruit World of Australasia*, xxxii, 8, p. 466, 1931.

Following a severe outbreak of peach rust [*Puccinia pruni-spinosae*: *R.A.M.*, x, p. 470] in the Murrumbidgee area, the New South Wales Ministry of Agriculture recommends growers to remove and burn all diseased wood with the prunings, to keep the leaves buried by cultivation, and to spray the trees with Bordeaux mixture 6–4–22 before the buds burst. If severe defoliation has occurred, every effort should be made to invigorate the trees during the growing season.

BRUCKER (K. W.). **Die Schrotschusskrankheit an Pfirsichbäumen.** [The shot hole disease of Peach trees.]—*Gartenwelt*, xxxv, 41, p. 567, 1 fig., 1931.

During the last two years the causal organism of shot hole (*Clasterosporium carpophilum*), which has been prevalent for some time on cherries in Germany [*R.A.M.*, x, p. 803], has also inflicted considerable damage on the leaves, shoots, and especially on the fruit of peach trees. In the Heidelberg district the most susceptible varieties are Rivers, Hales, York, Weisse Magdalene, Rosenthal's Canning, and Triumph, while Madame Rogniat, Königin der Obstgärten, Proskauer, and Roter Ellerstädter are resistant. The following spray schedule is recommended for the

control of this disease: (1) a dormant application of 15 to 20 per cent. lime-sulphur; (2) 2 per cent. Bordeaux mixture just before the opening of the flowers (also effective against leaf curl [*Taphrina deformans*]); (3) 2 per cent. lime-sulphur immediately after blossoming; (4) the same two to three weeks later.

FAES (H.) & STAEHELIN (M.). **Quelques cas de dépérissement de l'Abricotier en Valais.** [Some cases of dying-off of Apricots in Valais.]—Pamphlet of the *Stat. Fed. d'Essais Vitic., Lausanne*, 6 pp., [? 1931].

During 1930 the writers investigated various cases of dying-off of apricot trees in Valais, Switzerland, bearing some resemblance to the symptoms observed on the same host in France [*R.A.M.*, ix, p. 256]. The disease appears to be confined to three districts, viz., (1) near Martigny (Rhône Valley) in light, sandy soil; (2) at Charbonne on the Saxon slope at an altitude of 700 to 900 m. in loose, rich soil; and (3) at Réchy in the plain, on fairly heavy soil. Neither the situation of the orchards nor the composition of the soil seems to exercise a decisive influence on the course of the disturbance.

The affected trees fall into three groups: (1) characterized by very marked symptoms, including failure to form new shoots in the spring, rapid desiccation, browning of the phloem and cortex of large branches and the trunk, and swelling of the lenticels; (2) in which the same symptoms occur in a less conspicuous form; and (3) comprising individuals showing few external signs of disease apart from stunted growth and chlorotic foliage. Among the fungi found in or on the diseased trees were several true parasites, namely, species of *Clasterosporium*, *Fusarium*, *Monilia*, and *Verticillium*, but so far no evidence of their pathogenicity in respect of the dying-off disease has been obtained. Further studies on the physiological factors associated with the dying-off, as well as on the possible part played by the stock in the etiology of the condition, are considered to be necessary for the solution of a most complex problem.

THOMAS (H. E.). **Verticilliosis of Strawberries.**—Abs. in *Phytopath.*, xxi, 10, p. 996, 1931.

Strawberry plants in soil containing *Verticillium albo-atrum* at San José, California, showed a severe wilting, brown discoloration, or scorching of the edges of the outermost leaves [*R.A.M.*, ix, p. 16]. Partial recovery was observed in a number of plants, but others died. The fungus was readily isolated from the crowns of affected plants but not from the roots. Half the 30 plants inoculated in the greenhouse with *V. albo-atrum* developed the above-mentioned symptoms in five months, and the fungus was reisolated from the diseased crowns. The rest of the inoculated plants and 20 controls remained healthy.

SHEAR (C. L.), STEVENS (N. E.), & BAIN (H. F.). **Fungous diseases of the cultivated Cranberry.**—*U.S. Dept. of Agric. Tech. Bull.* 258, 57 pp., 4 pl. (2 col.), 33 figs., 6 graphs, 1931.

Technical diagnoses, accompanied in most cases by figures, are

given of the 38 most common species of fungi occurring on cranberries in the United States. The organisms fall into three groups, viz., eight important rot fungi, comprising *Godronia cassandrae*, *Glomerella cingulata* [var.] *vaccinii* or *G. rufomaculans* [var.] *vaccinii* [*R.A.M.*, ix, p. 257], *Guignardia vaccinii* [ibid., viii, p. 114], *Acanthorynchus vaccinii* [ibid., vii, p. 334], *Diaporthe vaccinii* Shear, n.sp., *Sporonema oxycocci* [ibid., vi, p. 304], *Ceuthospora lunata* [ibid., viii, p. 452], and *Pestalozzia guepini* [var.] *vaccinii* [ibid., iii, p. 281]; six causing diseases of the cranberry vines, namely, *Sclerotinia oxycocci*, *Exobasidium oxycocci*, *E. vaccinii* (considered by some investigators to be synonymous with the foregoing), *Mycosphaerella nigro-maculans* Shear, n.sp., *Synchytrium vaccinii*, and *Psilocybe agrariella* Atk. var. *vaccinii* Charles, n. var.; and fungi of minor importance. A further 31 species are listed as having occasionally been found in cultures from berries, roots, and vines, on berries and on leaves.

D. vaccinii, an important source of storage rot of *Vaccinium macrocarpon* and *V. oxycoccus* var. *intermedium*, is characterized by thick, black, carbonous, nearly hemispherical perithecia, 0·3 to 0·5 by 0·2 to 0·4 mm.; oblong-fusoid, sessile asci, 37 to 51 by 6·8 to 11·7 μ; and irregularly biseriate, ellipsoid, obtuse, bicellular, biguttulate ascospores, 8·8 to 11·8 by 2·4 to 3·4 μ. The thick-walled, black, leathery pycnidia (*Phomopsis vaccinii* n. f. nom.) range from 0·3 to 0·5 mm. in diameter on fruit to 1 to 2 mm. in cornmeal and potato-dextrose agar cultures; the pycnospores are hyaline, unicellular, with two prominent oil drops, long-elliptical, and measure 6 to 11 by 2 to 5 μ; and the fusiform, tapering sporophores are about 15 to 25 μ long in young pycnidia, somewhat longer in older ones; scolecospores were only once observed and were mostly hamate, measuring 14 to 20 by 0·35 μ. Single ascospore isolations from the *Diaporthe* produced typical *Phomopsis* colonies and pycnospores in culture. *Phomopsis* cultures made from decaying berries in the autumn and held over winter in an unheated building in Oregon produced perithecia by the following May, a fair proportion showing both pycnidia and perithecia in the same culture.

M. nigro-maculans n.sp., which also occurs on the above-mentioned species of *Vaccinium*, is characterized by subglobose, thick-walled, ostiolate, black perithecia, 60 to 105 μ in diameter; sessile, cylindrical, often somewhat curved asci, 23 to 35 by 3 to 4·5 μ; and uniseriate or irregularly biseriate, hyaline, bicellular, long-ellipsoid ascospores, 7·5 to 10 by 1·75 to 4 μ. The conidia (*Ramularia nigro-maculans* n. f. nom.), grown in culture from single ascospore isolations, are faint yellowish-brown, globose to elliptical, concatenate, unicellular, 2 to 6 by 2 to 3·5 μ, and are borne on pale yellowish-brown conidiophores, 2 to 3 μ in diameter. The new species appears to be closely related to *M. punctiformis* [ibid., vi, p. 177], from which it differs, however, in its slightly narrower asci and ascospores, perithecia confined to distinct black spots on the stems, berries, and leaves, in its pathogenicity, and in its host.

The physiology of the cranberry rotting fungi is discussed in some detail, with special reference to time of infection, dissemina-

tion, acidity, and temperature relations, and relative abundance of the fungi in different regions, particularly as affected by climatic conditions. Notes are also given on storage rots, attention being drawn to the connexion between general cultural practices in various localities and the control of fruit rot, which is considered under the following aspects: spraying, bog management, harvesting and handling methods, storage, and marketing of the crop. Particulars are also given of the decay of cranberries due to sterile breakdown or senescence.

A bibliography of 86 titles is appended.

TOMKINS (R. G.). **Wastage in the refrigerated transport of Canary Bananas from South America to Europe.**—*Trop. Agriculture*, viii, 10, pp. 255–264, 2 pl., 2 graphs, 1931.

This is a summary of the author's investigation in 1928 and 1930 at the ports of arrival in England, in conjunction with experimental work at the Low Temperature Research Station, Cambridge, of the causes of wastage during transport in cold storage of the Canary variety of banana [*Musa cavendishii*] from South America, chiefly from Brazil. While the conclusions arrived at are in general agreement with those of Wardlaw and McGuire from Trinidad [*R.A.M.*, x, p. 806], the losses in the South American shipments were found to be due mainly to 'ship ripes' (i.e. banana bunches that ripen in the 17 days or so of sea transit), and to main stalk and finger stalk rots. Among the many micro-organisms (including bacteria, moulds, and yeasts) isolated from rotting main stalks, *Gloeosporium musarum* [ibid., x, p. 324] and various species of *Fusarium* were always present, and *Nigrospora oryzae* was also of common occurrence; an interesting feature was the apparently almost complete absence of *Thielaviopsis* [*Ceratostomella*] *paradoxa* which causes such serious stalk rot in the Gros Michel bananas from Jamaica [cf. ibid., x, p. 44], and no damage due to this fungus was observed in the ripening rooms. The majority of the banana bunches arriving in England have their stalk rotted to the extent of three or four inches from the proximal end, in some the stalk is completely rotten for about 12 inches, including the first hand, and in only a few bunches does the stalk remain quite free from infection. The rot was experimentally produced by inoculation of the main stalk with *G. musarum*, and *Fusarium* spp., but it was not established which of these fungi cause most damage. At 56·5° F. (the temperature of the ship holds) only about one inch of the stalk was rotted in 19 days, the progress of the rot in the first ten days being approximately one quarter of that during the second period. These experiments are believed to indicate that in nature, infection most probably occurs at the time when the bunches are harvested, the fungi then making as much progress during the two or three days that precede the cold storage of the fruit in the ship holds as would occur in six to nine days at 56° F. The control measures recommended have already been discussed in a previous paper [ibid., ix, p. 729].

The finger [individual fruit] rot, as distinct from the main stalk rot, is associated with two types of spots, one of which actively spreads, and the other is of a non-spreading nature. The fungi

most commonly isolated from the first were *G. musarum* and a species of *Fusarium*, both of which invariably reproduced the rot in inoculation experiments; occasionally *N. oryzae* and bacteria are also present. The second type of spots yielded an undetermined species of *Pestalozzia* [a brief description of which is given] in 86 per cent. of the cases examined, but when inoculated into sound banana fingers, this fungus either failed to develop or produced a very slight rot. The experiments indicated that at the usual ship hold temperatures finger rot takes 24 to 48 days to develop, this again supporting the view that some fungal activity occurs on the fingers before the bunches are cooled for transit. Observations showed that this rot is the chief cause of the dropping of bananas from the bunches, and that there is a well-marked seasonal variation in its incidence, the maximum numbers of loose bananas in the ships and ripening rooms being found in December, followed by a steady decrease to a minimum in June, after which a steady rise occurs again.

In a final section the author briefly reviews the measures most likely to reduce the wastage of the Canary bananas in transit to Europe to a minimum.

WARDLAW (C. W.). **Banana diseases. I. Observations on Botryodiplodia fruit rot of the Banana.**—*Trop. Agriculture*, viii, 9, pp. 227–230, 8 figs., 1931.

This is an expanded account of the observations and experiments so far made in the study of the serious storage rot of banana fruits caused by *Botryodiplodia theobromae*, some results of which were given in a previous paper [*R.A.M.*, x, p. 806]. Reaped fruit may apparently be attacked by the fungus, which was shown to be essentially a wound parasite, at any stage of maturity, and it was occasionally observed on very immature bananas of the Cavendish variety Trinidad Governor [*Musa cavendishii*] while still on the plants. Field inoculations of fruits on the plants invariably gave negative results. The hyphae penetrate the tissues chiefly along the middle lamellae, but also pass freely from cell to cell; the flesh is rendered soft and pulpy, while the skin becomes dark, wrinkled, and covered with a crust of small black pycnidia. At laboratory temperatures in Trinidad (80° to 85° F.) and in the presence of sufficient humidity, the rot developed rapidly on inoculated bananas of varying stages of maturity, a characteristic effect of the fungus being a premature ripening of the fruit tissues in advance of its progress. The parasitic activity of *B. theobromae* on the banana is attributed to its rapid growth rate and considerable capacity for utilizing carbohydrates even at high concentrations.

In discussing the taxonomy of the fungus, which is stated to agree closely with previous descriptions of *B. theobromae*, it is suggested that *Diplodia musae* Died. described from Assam may be identical with it.

There was considerable evidence that the period of time that elapses before the infected fruit is placed in cool storage [see preceding abstract] is of fundamental importance in the subsequent development of the rots caused by the fungus, of which the following forms were observed, namely, main stalk rot, finger dropping, finger-

tip disease, and fruit spots and blemishes. It appears probable that control of this disease in transit depends in a large measure on curtailing to a minimum the time elapsing between reaping and cooling down the cargo in the holds to 53° F.

LINFORD (M. B.). **Further studies of transmission of the Pineapple yellow-spot virus by Thrips tabaci.**—Abs. in *Phytopath.*, xxi, 10, p. 999, 1931.

Further studies on the transmission of the pineapple yellow spot virus by *Thrips tabaci* [in Hawaii] revealed a specialized relationship between virus and insect [*R.A.M.*, xi, pp. 78, 116]. *Emilia flammea* was the chief test plant, supplemented by pineapple and others. The thrips were from three non-infective colonies reared each from an individual larva. The virus survives pupation and is transmissible by a single insect. Adults from non-infective colonies do not appear to become infective after feeding on diseased plants, but their progeny, developing on the same plants, acquire the infective principle. Larvae from non-infective colonies also become infective through feeding on diseased plants, and may transmit the virus while still in the larval stage or as adults. The incubation period in the larvae lasts about ten days. Yellow spot is not easily transmissible by mechanical means. The hosts of this disease include members of several unrelated families.

ILLINGWORTH (J. F.). **Preliminary report on evidence that mealy bugs are an important factor in Pineapple wilt.**—*Journ. Econ. Entom.*, xxiv, 4, pp. 877–889, 1 pl., 1931.

During the last four years the writer has accumulated evidence that the mealy bug *Pseudococcus brevipes* is largely concerned in the transmission of pineapple wilt in Hawaii [cf. *R.A.M.*, ii, p. 109; v, p. 716; viii, p. 53]. This disease, which is stated to be common wherever pineapples are grown, is characterized by flaccidity and a reddish or yellow discoloration of the leaves, followed by desiccation. These symptoms are not due, as generally supposed, to the death of the roots, since large normal plants were found to remain alive and green for months in the absence of soil roots. Infection usually starts near the edges of a field whence it rapidly spreads towards the centre. Close inspection of wilting plants shows peculiar greenish spots ('chlorophyll spots') on the upper side of some of the inner leaves, caused by the feeding of wilt-infected mealy bugs, which crawl from diseased to healthy plants as soon as the former become dry. The spots appear on the healthy leaves about a fortnight later, followed in two or three months by wilting of the foliage.

The chlorophyll spots, which constitute an important diagnostic character of wilt, begin far down in the leaf axils where the insects feed. The chlorophyll, apparently stimulated by the biting, concentrates round the individual punctures in circular areas varying from 3 to 7 mm. in diameter. As the leaf grows, the pale or yellow centres become raised; in older spots the centres are darker green, surrounded by a paler halo. At certain stages of development the spots exhibit concentric zonation. Spotting of this type

is frequently observed on planting material, the use of which is evidently responsible for the isolated cases of wilt found even in otherwise healthy fields.

In Hawaii, as in other pineapple-growing countries, the destructive effects of wilt have shown a marked cumulative development, especially during the last two decades. In 1912 J. E. Higgins reported (*Hawaii Agric. Exper. Stat. Bull.* 36, p. 30) that the disease caused little damage, but by 1920 whole fields had been wiped out and the losses have continued unabated since that date. Wilt is now undoubtedly the most serious factor curtailing pineapple production in Hawaii, where the annual losses from this cause are estimated at well over one million dollars.

The results of experiments [which are fully discussed and tabulated] under controlled conditions showed conclusively that mealy bugs convey the wilt infection from diseased to healthy plants after feeding on the former, about three months elapsing before the outer leaves turn yellow though the peculiar chlorophyll spotting appears very soon. Neither the typical chlorophyll spots nor the later symptoms of wilt were produced by mealy bugs that had not first fed on diseased plants.

Cultural measures for the control of wilt should include thorough preparation of the fields, eliminating hold-over stumps, grass roots, and the like ; the selection of unspotted plants ; and sanitation of field borders. Recommendations for the control of the mealy bug vector are also given.

Dickson (B. T.), Angell (H. R.), & Simmonds (J. H.). **The control of soft rot (water blister) of Pineapples caused by Thielaviopsis paradoxa.**—*Journ. Australia Council Sci. & Indus. Res.*, iv, 3, pp. 152–161, 1931.

After stating that pineapple water blister (*Thielaviopsis* [*Ceratostomella*] *paradoxa*) [*R.A.M.*, x, pp. 223, 473] is estimated to cause an annual loss in Australia of £10,000 and that an examination of 1,148 diseased fruits in Sydney markets during February and March, 1929, revealed that 75·5 per cent. of the infection originated from the cut surface of the stem, 22·3 per cent. presumably through side wounds, and 2·2 per cent. at or near the junction of the crown and fruit, the authors describe tests with fungicides applied to the cut surface of the stem to prevent the growth of the fungus.

The results [which are tabulated and discussed] showed that benzoic acid applied up to five and a half hours after inoculation with the conidia of *C. paradoxa* completely prevented infection. Salicylic acid gave equally good results and boric acid, borax, and calcium hypochlorite also materially reduced the amount of disease. Laboratory experiments on the effects of inoculation of unwounded and injured surfaces of the fruit lead the authors to conclude that infection by *C. paradoxa* seldom, if ever, takes place except through wounds or bruises.

None of the fungicides mentioned, except benzoic acid, is, however, permissible under the New South Wales health regulations. For commercial purposes the authors recommend brushing the stems with an alcoholic solution of benzoic acid of not under

10 per cent. strength or rubbing them in a mixture of one part benzoic acid to not more than four parts by weight of kaolin.

Laboratory studies of artificially inoculated pineapples showed that water blister develops most rapidly between 23° and 29° C.; below 12° there was no evidence of rot even after seven days. The losses at present incurred would probably be greatly reduced if facilities were available for low temperature transport and storage during summer.

RANT (A.). **Über eine Bakterienkrankheit bei dem Melonenbaume (Carica papaya Linn.) auf Java.** [On a bacterial disease of the Papaw (*Carica papaya* Linn.) in Java.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxiv, 23–26, pp. 481–487, 4 figs., 1931.

Papaw (*Carica papaya*) plants in Java and the Molucca Islands were recently observed by the author to be suffering from a bacterial disease with the following features. In young plants the leaves turn yellow and decay and the upper part dies, the whole plant often becoming involved. Dry spots develop and expand on the leaf blades of larger plants, especially along the main veins. Water soaked lesions appear on the petioles and stem and spread rapidly; the affected parts are sticky to the touch owing to the exudation of latex. In some cases the yellow leaf dies before infection reaches the stem. Slender stems gradually die off from the top downwards, but in stouter plants recovery of the affected parts may be observed.

A short, rod-shaped organism with rounded ends, 1 to 1·5 or up to 3 μ in length, was isolated on papaw agar. Some of the individuals were motile while others were non-motile, but in view of the complete agreement of both types in morphological and pathogenic characters they may safely be regarded as identical. The bacterium is Gram-negative but stains faintly with aniline dyes, it does not form spores, is aerobic, produces acids but no gas from glucose, levulose, saccharose, mannitol, and dulcitol, and grows best at room temperature (maximum and minimum 45° and $\pm$10° C., respectively). The organism is named *Bacillus papayae* n. sp.

Inoculation experiments with bacterial suspensions (motile and non-motile) gave positive results both on wounded and unwounded petioles. In one test only three out of 45 inoculations on the leaf blades were successful, compared with 25 out of 41 on the petioles, presumably owing to the large number of stomata serving as points of ingress for the bacteria on the latter organs. Stomata are present on the under side of the leaf but absent from the upper, and in a laboratory test 13 out of 19 inoculations were successful on the former compared with two or three on the latter. Inoculation experiments on a number of other cultivated plants [which are enumerated] gave entirely negative results.

Ants were observed to transmit infection from petiole to petiole on the same plant, and probably flying insects carry the organism from one plant to the next. Diseased organs should be cut off and burnt immediately.

Miss E. M. Doyer reports that papaws in the Semarang district

of Java suffer from a similar disease, the causal organism of which, however, appears to be much less virulent than the foregoing.

WOODMAN (R. M.). **An examination of some commercial suspensions used in the spraying of plants.**—*Journ. Soc. Chem. Ind.*, l, 42, pp. 391T-397T, 6 figs., 1931.

The writer discusses and tabulates the results of his investigations, conducted at the Cambridge Horticultural Research Station, of some commercial suspensions used for the spraying of plants.

Ialine sulphur [*R.A.M.*, ix, pp. 467, 794], manufactured by Burt, Boulton & Haywood, Ltd., is dependent on the minute size of the sulphur particles for its suspension, nitrogen-containing protective colloids being absent. The firm recommends the addition of soft soap to the water used for making a suspension, probably to enhance the wetting and spreading capacity. Ialine is considered to be probably the most successful commercial sulphur at present available for forming spraying suspensions.

The toxic agents in bouisol (a suspension to replace ordinary Bordeaux) and sulsol (a sulphur suspension) are, according to the manufacturers (Einstein's Electro-Chemical Process, Ltd.), ground in patented machinery in such a way that the particles are 'decohesionized', the process being carried out in the presence of water, a small quantity of protective colloid, and an anti-putrescent agent. After sedimentation the suspensions contain about 20 per cent. of the toxic agent.

The total solids in the bouisol, sulsol, and ialine sulphur suspensions were 29·50, 13·29, and 29·69 per cent., respectively. The two sulphur suspensions were diluted to 2 per cent. solids present, a second 2 per cent. ialine, to which 0·5 per cent. soft soap was added was included, and a bouisol suspension was prepared to contain the same amount of solids as that present in a Bordeaux mixture of 1 gm. $CuSO_4$, $5H_2O$; 1 gm. CaO (98 per cent.); 160 c.c. water. Fifty c.c. of these suspensions were placed in 50 c.c. stoppered cylinders and photographed from time to time. Photomicrographs were also made of drops of the suspensions on glass slides. Bouisol showed no signs of clearing in three hours while the Bordeaux mixture showed 6 c.c. of clear supernatant liquid. After 24 hours ageing, reshaking, and placing aside, the Bordeaux mixture gave clear supernatant layers of 8·75 and 18·5 c.c. in 15 and 30 minutes, respectively, while bouisol again showed no sign of sedimentation. The clearing and sedimentation of the sulphur suspensions could be followed better by the eye than by photography; after 20 days the ialine plus soap suspension was practically clear of sulphur, the ialine suspension without soap showed 27 c.c. of clear supernatant liquid, while the sulsol suspension had only partially cleared to a depth of 3 c.c. The photomicrographs indicated that bouisol was much more finely particled than Bordeaux, while the sulphur particles in sulsol and ialine (especially the former) were also very fine and evenly distributed. The addition of soap to ialine, though promoting wetting and spreading, appeared to cause the coagulation of the sulphur to larger particles. The photomicrographs of the solid

residues left after the drying of these droplets were very similar and were compared with photomicrographs of (*a*) flowers of sulphur, (*b*) kolodust (Niagara Co) [*R.A.M.*, x, p. 441], (*c*) a dry sulphur spray sold by G. Monro, Ltd., and (*d*) one sold by Butler & Co. Flowers of sulphur was found to have the smallest particles of these dry sulphurs. Sulsol was finer and more evenly distributed than ialine, while ialine plus soap was a more coarse-grained film with few sulphur particles. In all these three preparations, however, the particles were smaller than the agglomerates obtained with the dry dusts. The superior stability of sulsol appears to be almost entirely attributable to the fineness of its particles.

DEL GIUDICE (E.). **Alcune esperienze sull'azione anticrittogamica dello solfo.** [Experiments on the fungicidal action of sulphur.] —*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 128–137, 1931.

After referring to the different opinions which prevail as to the true nature of the fungicidal properties of sulphur [*R.A.M.*, ix, pp. 468, 732, 733; x, p. 741] the author describes a number of laboratory and field tests made as to the relative value of the two wind-blown natural raw sulphurs known, respectively, as 'solfo greggio ventilato S.A.I.M.' [ibid., viii, p. 545; ix, p. 286] and 'solfo greggio Romagna M.S.R.' [ibid., viii, p. 701], pure, wind-blown sulphur, and of pure, sublimed, commercially prepared sulphur. The first-named consists of 36·25 per cent. sulphur, 48·5 per cent. calcium carbonate, 7 per cent. magnesium carbonate, 6·7 per cent. calcium sulphate, and 1 per cent. clay, while the second contains 34·4 per cent. sulphur, 46 per cent. calcium carbonate, 5 per cent. magnesium carbonate, 5·5 per cent. calcium sulphate, 2·5 per cent. silica, and 5 per cent. organic matter. The P_H values of pure wind-blown sulphur, the pure sublimed sulphur, the S.A.I.M., and the Romagna M.S.R. were, respectively, 6·8, 3, 7·6, and 7·7.

When these dusts were tested upon aqueous suspensions of the conidia of *Erysiphe graminis* and the uredospores of *Puccinia glumarum* the percentages of spores of the former which germinated after four days were: control in distilled water only ($P_H = 7$) 29, ditto plus sublimed sulphur 2, ditto plus pure wind-blown sulphur 2, ditto plus S.A.I.M. 9, and ditto plus M.S.R. 18. The corresponding figures with *P. glumarum* were 29, 1, 6, 8, and 19 per cent., respectively. These tests were carried out in diffused sunlight; with both organisms the relative fungicidal values of the different treatments remained the same when the tests were repeated in darkness. The fungicidal superiority of the sublimed sulphur with P_H value 3 is clearly evident from these results, especially when compared with the M.S.R. with P_H 7·7.

The difference in the fungicidal efficacy of these two forms appearing disproportionate to their respective P_H values, the author investigated what effect the P_H value of the water (modified by adding sodium carbonate or sulphuric acid) had on the germination of the spores. It was found that a P_H value of 3·6 reduced germination by three-quarters in 24 hours, while one of 8·2 caused less reduction. The author considers that an acid reaction undoubtedly increases the fungicidal activity of sulphur.

Tests of the germination of the spores of *P. glumarum* treated with aqueous filtrates of the various forms of sulphur gave the following percentage germinations after 24 hours: control (distilled water) 15, pure sublimed sulphur 2, pure wind-blown sulphur 4, S.A.I.M. 5, and M.S.R. 7, the P_H values of the liquids being 7, 3, 6·8, 7·6, and 7·7, respectively. The depression of germination caused by the pure, sublimed sulphur is considered to be due to the formation of pentathionic acid [ibid., x, p. 535].

When the various forms of sulphur tested were placed on healthy wheat leaves and other wheat leaves artificially infected with *P. glumarum* only the raw, wind-blown S.A.I.M. sulphur produced hydrogen sulphide. The P_H value of the water used had no effect on the liberation or otherwise of this gas. No hydrogen sulphide was produced when the sulphur was deposited on an inert surface, such as glass, but it was constantly produced by the S.A.I.M. sulphur in 24 to 48 hours when placed on a living leaf attached to the plant and having numerous stomata [cf. ibid., x, p. 741].

In the author's opinion, there is no doubt that under certain as yet incompletely determined conditions, but which as regards the natural wind-blown S.A.I.M. sulphur must partly consist in the nature of the gangue with its content of calcium and gypsum, the sulphur goes through a process of hydrogenation with the resultant formation of hydrogen sulphide. This probably accounts for the slightly superior efficacy of the S.A.I.M. sulphur as compared with the M.S.R.

Field tests in which each of the three wind-blown sulphurs was applied to wheat affected with *P. triticina* completely confirmed the results of the laboratory experiments, the plot showing the least disease being that treated with the pure wind-blown sulphur and that most affected (after the untreated control plot) being the one treated with M.S.R.

The natural sulphurs, though less efficacious in these tests than the pure forms, are nevertheless good enough for all practical purposes.

Bech (P.), Bruun (S.), Friis (S.), Jensen (C. E.), Nielsen (V.), Pedersen (A.), & Risum (J. N.). **Hovedprøve med Motorfrugttræsprøjter.** [Main experiments with motor fruit tree sprayers.]—*Statens Redskabsprøver Beretning* 64, pp. 1–45, 12 figs., 6 diags., 1931.

Full technical details, supplemented by 13 tables, are given of the construction and application of four motor spraying apparatus for fruit trees—the first to be tested in Denmark—namely 'Platz' (Brødr. Bendix, Gl. Torv 18, Copenhagen K), 'Friend' (Ingeniør J. Hansen, Østerbrogade 2A, Copenhagen Ø), 'Sigvardt' (Fabrikant R. Sigvardt, Orehoved Motorfabrik, Orehoved), and 'Bean' (Grosserer J. Svendsen, Bernstorffsgade 17, Copenhagen K). All the machines gave eminently satisfactory results. A stationary spraying apparatus, the 'Bean' triplex pump, suitable for working an area of about 2 hect., was also inspected. The prices of the apparatus are as follows: 'Bean' Kr. 2,250, 'Friend' Kr. 1,800, 'Platz' Kr. 2,085, and 'Sigvardt' Kr. 1,800.

TULASNE (L. R.) & TULASNE (C.). **Selecta Fungorum Carpologia.** Translated into English by W. B. Grove.—Vol. i, A to DD + i to xxvi + 250 pp., 5 pl.; vol. ii, i to xxiv + 304 pp., 34 pl.; vol. iii, i to xx + 208 pp., 22 pl., Oxford University Press, 1931.

After some 70 years these classical volumes have been worthily translated into English. The originals have been reproduced as closely as possible both in the format and typography of the text, and in the collotype reproductions of the famous plates. After prefaces by the editors (A. H. R. Buller and C. L. Shear) and the translator, four obituary notices of the brothers are inserted; and these recall the estimation in which they were held in their own day.

The first volume is mainly devoted to an account of the nature and structure of fungi, and of various hypotheses dealing with them. The authors then settle down to descriptions of genera and species of the Ascomycetes and of the Imperfect Fungi that they held to be associated with each. The species were nearly all collected alive by the authors ('and more than once'), and were selected as furthering their hypothesis of the polymorphism of the Ascomycetes. Rather more than 200 species were described, and of these nearly 150 were figured. They refrained from making new species unaccompanied by figures as they found that 'we are unequal to the task of describing many of these fungi so satisfactorily in words alone, that a mycologist may safely recognize to which we refer'. It was this plain account of repeated collection and accurate description, and above all else, this welding of discreet specimens into living species that earned for one brother the title of 'Reformer of Mycology'. It is the 'superb illustrations' of the other, 'the despair of later botanists' which played, and still play, such a part in introducing students to these difficult genera. It might have been thought that by this date all the suggestions as to the different spore forms of these species would have been confirmed or refuted; a melancholy number, however, remain in the category of not proven.

Appendices by the editors at the end of each volume give the currently accepted names of the fungi.

HANSEN (H. P.). **Om resistens mod smitsomme plantesygdomme.** [On resistance to infectious plant diseases.]—*Ugeskr. for Landmænd*, lxxvi, 42, pp. 662–664, 1931.

Some general observations, supported by concrete examples, are made concerning the various factors involved in the resistance or susceptibility of plants to fungous and bacterial diseases.

VERNON (T. R.). **An improved type of moist chamber for studying fungal growth.**—*Ann. of Botany*, xlv, 180, pp. 733–737, 2 figs., 1931.

Finding in a preliminary study of the moulds occurring on dairy products that the fine structure of the conidiophore and the arrangement and mode of attachment of the conidia are difficult to detect in ordinary Petri dish cultures or hanging drops, the writer devised the following technique for this purpose. A small

quantity of hot medium (80° to 90° C.) is placed on a sterile slide and flattened, just before setting, by means of a sterile cover slip, which is removed from the disk of medium as soon as the latter has thoroughly set (in about two minutes). The disk is then cut across diametrically with a sterile knife or razor blade and half pushed to one side, leaving a space of ½ to 1 cm. between the cut surfaces, one of which is inoculated and rapidly covered with a sterile cover-slip. The culture is then incubated in a moist atmosphere. Gelatine media are not suitable for this method owing to the risk of tearing by removal of the cover-glass, but any agar medium may be used, a plain 2 per cent. agar having given good results with many organisms. A great advantage of this method is that the main direction of growth is at right angles to the line of vision, so that a lateral view of the developing structures is obtained.

MELIN (E.). **Investigations of the significance of tree mycorrhiza: an ecological-physiological study.**—175 pp., 48 figs., Ann Arbor, Michigan, Edwards Bros., 1930. [Mimeographed.]

This is a translation from the German by P. W. Stickel of Melin's book on the ecology and physiology of tree mycorrhiza, the German edition of which has already been noticed [*R.A.M.*, v, p. 245].

VERPLANCKE (G.). **Dégâts causés à la végétation par les émanations des usines.** [Injury to vegetation caused by fumes emanating from factories.]—Reprinted from *La Tribune Hort.*, xxv, 717–720, 14 pp., [? 1931].

The author describes in some details the injury caused to cultivated plants in Belgium by the fumes emanating from industrial factories, each of the noxious products being considered separately. While freely admitting that the complaints of agriculturists in this regard are often well supported by evidence, he considers that in many cases they are due to prejudice, as shown by a few instances quoted by him. The suppression of existing factories by local or central authorities, following such complaints, should only be resorted to after exhaustive investigation.

ANGELL (H. R.) & HILL (A. V.). **The longevity of the conidia of certain fungi (Peronosporales) under dry conditions.**—*Journ. Australia Council Sci. & Indus. Res.*, iv, 3, pp. 178–181, 1931.

When the conidia of the *Peronospora* causing downy mildew or blue mould of tobacco were placed in desiccators at 16° to 18° C. they retained their viability for 35 days; the conidia of *P. parasitica* from cabbage showed a trace of germination after desiccation for ten days at 2° or at 16° to 18°, while those of *Bremia lactucae* from lettuce gave 1 per cent. germination after 35 days' desiccation at 2° or after 17 days at 2° with 60 to 70 per cent. relative humidity, and 70 per cent. germination after ten days at 2° with 60 to 80 per cent. relative humidity.

The experiments with the tobacco *Peronospora* [*R.A.M.*, x,

p. 492] also appeared to indicate that at certain temperatures the viability of conidia undergoing desiccation may be longer than that of conidia in ordinary or water-saturated atmospheres.

In no experiment was germination obtained after more than nine days in ordinary laboratory conditions.

HAINES (R. B.). **The influence of temperature on the rate of growth of Sporotrichum carnis, from −10° C. to +30° C.**—*Journ. Exper. Biol.*, viii, 4, pp. 379–388, 2 figs., 4 graphs, 1931.

Sporotrichum carnis is stated to be of frequent occurrence on lean stored meat kept for eight to ten weeks at a temperature below 0° C. but above −10° [*R.A.M.*, iii, p. 53; ix, p. 185]. Experiments were conducted at the Low Temperature Station, Cambridge, to determine the influence of temperature on the development of this mould.

Growth rate measurements on Czapek's agar indicated that the optimum temperature for growth is 25°; at 30° development is restricted and the germ-tubes from the spores are abnormally thickened. Fairly good, though slow growth was obtained at −5° on supercooled agar; here also the development of the fungus was limited and the germ-tubes tended to become thicker and curl more readily than at higher temperatures.

A curve is given showing the relation between temperature and growth rate during the logarithmic phase, from which it appears that growth on supercooled agar becomes infinitely slow at −10°. The application of the Arrhenius–van't Hoff equation to the results obtained is briefly discussed.

PETRI (L.). **Maculatura interna ereditaria dei tuberi di Patata.** [Internal hereditary spotting of Potato tubers.]—*Boll. R. Staz. Pat. Veg.*, N.S., xi, 2, pp. 171–175, 1 fig., 1931.

A description is given of the internal spotting of potato tubers characteristic of hereditary sprain [*R.A.M.*, ix, p. 199] which has been known in Italy for three or four years. In the winter of 1930–31 tubers received from Germany were found to be affected. These were sown in three separate localities, with the result that nearly all the new tubers dug up the following spring showed the condition. The disease comes into category 5 of Quanjer's classification of potato virus diseases [ibid., x, p. 746], is hereditary through the tubers, and is transmissible in the tissue juices by means of artificial inoculations or insect vectors. It is quite distinct from the condition known in France as 'maladie des tâches en couronne', in Holland as 'kringerigheid' and in Germany as 'Pfropfenbildung' which partly corresponds to internal brown spot. The last-named originates in the lenticels, is not hereditary, and falls into category 6 of Quanjer's classification.

ELZE (D. L.). **De overgang van virusziekten met het zaad, in het biezonder bij de Aardappel.** [The transmission of virus diseases with the seed, especially in the Potato.]—*Tijdschr. over Plantenziekten*, xxxvii, 10, pp. 189–197, 2 pl., 1931.

In connexion with a general survey of contemporary investiga-

tions on the mode of transmission of the virus diseases, especially of potatoes, the writer briefly summarizes the results of his recent experiments in the transmission of aucuba mosaic and leaf roll, a more detailed account of which has already appeared [*R.A.M.*, x, p. 813].

WHITEHEAD (T.). **On the transmission of Potato leaf-roll by Aphides.**—*Ann. of Appl. Biol.*, xviii, 3, pp. 299–304, 1 pl., 1931.

A brief account is given of experiments under greenhouse conditions in 1929 and 1930, the results of which established that the aphid *Myzus circumflexus* is as efficient a vector of potato leaf roll as *M. persicae* [*R.A.M.*, x, p. 49; cf. also x, p. 813]. It was noted, however, that in 1930 leaf roll symptoms took 16 days longer to develop on potato plants (President variety) infected by means of *M. circumflexus* than on those inoculated by *M. persicae*, and the academic and practical implications of this fact are discussed. *Macrosiphum gei*, in parallel experiments, transmitted the disease only once, thus leaving its importance as a carrier in the field still open.

MALHOTRA (R. C.). **Biochemical investigation of mosaic in Solanum tuberosum.**—*Journ. of Biochem.*, xiii, 3, pp. 473–487, 1931.

After a brief review of some of the literature on mosaic diseases of plants, the writer gives an account of his biochemical studies at St. Mary's, Kansas, on healthy and mosaic Burbank potatoes, the latter being infected by the expressed sap of a true tomato mosaic plant.

The results [which are tabulated and discussed] of an analytical examination of the experimental material indicated that healthy plants made better growth, both on the fresh and dry weight basis. The percentage of dry matter, however, was higher in the mosaic plants. Percentages of ether extract, non-reducing sugars, starch, hemicelluloses, and calories of heat per gram were higher in healthy plants, while nitrogen and inert materials (including cellulose) were relatively more abundant in diseased individuals. The percentage amounts of ash and reducing sugars were approximately equal in both lots.

JONES (A. P.). **The histogeny of Potato scab.**—*Ann. of Appl. Biol.*, xviii, 3, pp. 313-333, 2 pl., 3 figs., 1931.

This is a detailed account of the author's study of the histological lesions in potato tubers caused by common scab, of which he distinguishes two types, namely, the pitted type resulting from attacks by *Actinomyces scabies*, and the raised or 'tumulus' type caused by *A. flavus* Millard and Burr [*R.A.M.*, vi, p. 179]. In the first type infection may start in a tuber lenticel before its suberization, the meristem being then stimulated to division and producing an elongated type of cell; the new cells are invaded and killed by the fungus, but after a time a barrier of wound cork

is laid down. The organism is able, however, to grow through incompletely suberized cells in this barrier and to infect the cells below, when the process is repeated. No more than three cork barriers were found in any one scab, but this is believed to be due to arrest of the active growth of the tuber. The parasite was observed within the host cells in all stages of scab, and has also been induced to grow in the living tissues of potato rootlets, etiolated potato shoots, and in plugs of tuber tissue. It was seen to fructify freely and typically in the tissues of mature scabs and of potato plugs. The organism was finally shown to form brown, actinomycetous nodules on the roots developing from inoculated shoots, and to attack the cortical cells of such roots, greatly hindering the normal development of the root system.

The scabs of the raised type were found to be more superficial and to have only one cork barrier separating them from the healthy tissue. In naturally formed scabs of this type a species of *Actinomyces* was seen, closely resembling *A. flavus* in the characters of the sporophores and spores, both in pure culture and in scabs artificially produced by inoculations with it. The organism was shown to grow less rapidly than *A. scabies*, a fact which may account for its inability to grow through the first cork barrier.

The formation of wound cork below the scabs is thought to be possibly due to the development, during the early stages of invasion, of a gradient of P_H values in the tuber tissues favourable to cell division [cf. ibid., iv, p. 305; vi, p. 46], while in later stages, owing to the increased activity of the organisms in the infected regions, conditions favouring suberization are set up in the newly divided tissues. The suggestion is made also that the period of susceptibility of potato tubers to, at least, the pitted form of common scab, is probably determined by the degree of suberization of the tuber lenticels.

CHAMBERLAIN (E. E.). **Corticium disease of Potatoes. I. Propagation and spread of the disease.**—*New Zealand Journ. of Agric.*, xliii, 3, pp. 204–209, 4 figs., 1931.

After stating that the disease caused by *Corticium vagum* [*C. solani*] is one of the commonest troubles of potato crops in New Zealand, the author gives brief details of experiments started in 1928 at Palmerston North, the results of which indicated that in one-year crop rotation tests an apparent reduction in the degree of infection of the soil was only brought about when the potatoes followed grass, and not when following cereals, peas, or turnips. Further experiments showed that under market-gardening conditions *C. solani* persists in the soil for several years, and that under field conditions, with a normal distance of 14 inches between the potato hills, which were planted alternately with infected and healthy tubers, the spread of the disease through the soil led to an increase in the number of diseased plants of between 23 and 62 per cent. The latter fact is considered to explain the natural increase of infection of potato lines with *C. solani*. Infection was also shown to spread from diseased to healthy tubers stored in sacks.

CHEAL (W. F.). **Experiments on Potato sickness.**—*Ann. of Appl. Biol.*, xviii, 3, pp. 401–403, 1 pl., 1931.

The author states that the results of his experiments in 1930, in continuation of his study of the causes of 'potato sickness' of soil [*R.A.M.*, ix, pp. 125, 335], showed that potato plants in pots of sterilized earth inoculated with *Corticium solani*, *Colletotrichum atramentarium*, and *Heterodera schachtii* cysts, were definitely retarded in their initial growth, but later appeared to make up leeway, and finally almost caught up with the controls. Tubers naturally infected with *C. atramentarium* again failed to produce diseased plants, in confirmation of the results of the previous year's work [loc. cit.; cf. also x, p. 546].

POLI (P.). **Studio sul 'mal del collo' del Riso.** [Study on 'collar rot' of Rice.]—*Giorn. di Risicolt.*, xxi, 10, pp. 149–157, 2 figs., 1 graph, 1931.

The average loss from 'collar rot' or 'brusone' of rice [*R.A.M.*, vii, p. 394] in the province of Vercelli [Piedmont] may be estimated at 10 to 15 per cent., while in severe cases the yield may be reduced by 40 to 50 per cent. The Originario and Americano 1600 varieties have been found most susceptible. A study of the meteorological records for the period from June to September, 1931, indicates that the disease is favoured by continuous sharp fluctuations in temperature, such as occurred during the abnormal summer of that year, rather than by temporary cool spells.

BOBILIOFF (W.). **Anatomisch onderzoek bij de topinstervingen van jonge Hevea-uitloopers.** [Anatomical investigation of young *Hevea* shoots suffering from top die-back.]—*Arch. voor Rubber-cult. Nederl.-Indië*, xv, 10, pp. 627–635, 10 figs., 1931. [English summary.]

In the non-parasitic die-back of budded *Hevea* rubber shoots in Java [*R.A.M.*, xi, p. 72], as in that caused by *Phytophthora* [*palmivora*], the tops wither and shrivel, while the leaves also wither, blacken, and finally drop. These features pointed to the obstruction of the water supply by a stoppage in the conducting channels, and this was actually found to occur at the junction of the scion with the stock. In severe cases the scion dies off completely, but where the stoppage is slighter one or more lateral buds usually develop after the death of the top of the shoot. Similar manifestations are found on non-budded shoots arising from stumps with thick stems and sometimes on the shoots developing from trees of which the crowns have been removed owing to damage from wind or other causes.

The stoppage was mainly due to internal fissures which may form at the point of origin of a normal shoot from a thick stem, and also at the juncture of stock and scion; these become filled with coagulated latex extruded from the surrounding ruptured tissue. Sometimes there is an outgrowth of wound-tissue as well as a latex flux into the fissure. Such fissures, the exact cause of which is not known, exert a very adverse influence on the subsequent development of the shoot, which remains stunted and

swollen, while the new shoots that are formed fail to attain their full size.

OCFEMIA (G. O.). **The diseases of Sugar Cane occurring at the College of Agriculture at Los Baños and in the immediate neighbourhood.**—*Sugar News*, xii, 9, pp. 595–599, 1931.

Brief, popular notes are given on the following diseases of sugar-cane occurring at or near Los Baños, Philippine Islands: bacterial stem rot (*Bacillus sacchari*) [*R.A.M.*, x, p. 690], banded sclerotial disease (*Rhizoctonia* [*Corticium*] *solani*), leaf spot (*Cercospora kopkei*), Fiji disease, eye spot (*Helminthosporium sacchari*), leaf scald (*Bacterium*) [*albilineans*], mosaic, pineapple disease (*Ceratostomella paradoxa*), pokkah-boeng (*Fusarium moniliforme*) [*Gibberella moniliformis*], red rot (*Colletotrichum falcatum*), ring spot (*Leptosphaeria sacchari*), root rot associated with *Pythium* [ibid., xi, p. 5], rust (*Puccinia kuehnii*), *Sclerotium* disease caused by a fungus of the *S. rolfsii* group, smut (*Ustilago scitaminea*), and wilt (*Cephalosporium sacchari*).

ROLDAN (E. F.). **A bacterial stem-rot of hybrid Cane seedlings hitherto unreported.**—*Philipp. Agric.*, xx, 4, pp. 247–260, 5 pl., 1931.

This is an expanded account of the writer's studies on the newly discovered stem rot of hybrid sugar-cane seedlings in the Philippines caused by *Bacillus sacchari* n. sp. (*Erwinia sacchari* n. sp.) [see preceding abstract].

The following varieties have been found susceptible: Plant Breeding 308, P.B. 309, P.B. 345, P.B. 395, and P.B. 407, which are hybrid seedling canes from crosses between P.B. 119 (female) and C.A.C. 87 (male), as well as on Cagayan Striped. The first noticeable symptom of the disease is a yellow to yellowish-brown discoloration of the entire foliage, followed by rolling and wilting. Rapid discoloration to a pale greenish-yellow hue and softening of the inner tissues of the stalk next ensues, accompanied by rotting of the side buds and the region of the growing point of the shoot, with the result that the tops of infected stalks fall over a few centimetres below the spindle. This process is accelerated by cool, humid conditions. In the advanced stages of the disease the infected stalks emit an unpleasant odour of fermentation and putrefaction. The rind loses its natural gloss and becomes dull, as though scalded with hot water. In the young, tender tissues of the growing region fissures, apparently due to cell disorganization by bacterial action, may be seen running parallel with the fibres. The disease may occur on young canes about 60 cm. in height but is more common on those approaching maturity.

The causal organism [a technical diagnosis of which is given in English] was readily isolated on nutrient broth or cane juice-peptone-water. *B. sacchari* is a cylindrical rod with rounded ends, occurring singly, in pairs, or occasionally in chains and clumps, and measuring 0·95 to 2·2 by 0·5 to 0·7 μ. The rods stain readily with carbol fuchsin and aniline gentian violet; they are motile by means of four or more peritrichiate flagella. Heavy pellicles are formed in beef peptone, cane juice-peptone, and in

Cohn's and Fermi's solutions. On agar-beef-peptone the colonies are circular, raised, umbonate, smooth, pale green, and homogeneous, the buried ones being fusiform and variously umbonate. The yellow coloration of the organism on potato plug agar is not considered to represent true chromogenesis. Gelatine is liquefied, milk coagulated, and ammonia and indol produced. Acid is formed with evolution of gas in saccharose, mannite, raffinose, lactose, maltose, levulose, xylose, rhamnose, and melozitose, and acid without gas in glycerine, dextrin, dulcitol, and inulin. The optimum temperature for growth is 30° to 35° C. at a range of −20 to +20 Fuller's scale (optimum +10). In 24- and 48-hour-old fluid cultures *B. sacchari* succumbs to desiccation in 24 hours.

Inoculation experiments with pure cultures of the organism on hybrid seedling canes in the field gave positive results, 60 to 90 per cent. of infection being caused by inoculation through the spindle, compared with 30 to 60 at the base. The symptoms induced by the latter mode of inoculation agreed exactly with those occurring in nature, whereas in the case of spindle inoculation infection was confined to the growing point. The incubation period ranged from 3 to 7 days for inoculation through the spindle and from 6 to 10 days through the base.

In its present form the bacterial stem rot may be readily controlled by the eradication and burning of diseased stools as soon as infection is observed among them. No cuttings for planting should be taken from stools containing diseased stalks. In cases of severe infection the stalks of the stools should be cut and burnt with the stubble, while the soil should be ploughed up and exposed to direct sunshine to dry and so kill the bacteria harboured in the cane débris.

BELL (A. F.). **Sources of gumming infection.**—*Australian Sugar Journ.*, xxiii, 7, p. 365, 1931.

In response to a request for information as to the advisability of planting sugar-cane immediately after the ploughing in of a crop affected by gumming [*Bacterium vascularum*] in the Bundaberg area of Queensland [*R.A.M.*, x, pp. 128, 339], the writer states that this practice must be condemned outright. A number of volunteer stools are almost certain to grow out from the remains of those of the old crop. In the ordinary way these would be destroyed by a subsequent ploughing, but with immediate replanting they grow up among the shoots of the new crop and rapidly infect the latter as soon as suitable wet weather conditions occur, notwithstanding the use of healthy setts. If, however, planting is delayed until after the destruction of the volunteer stools, the new crop will be safe, since experiments have shown that the gumming organism is not transmissible through the soil.

ROXAS (J. V.). **An agronomic study of Indian Cane varieties, Rakhra, Hemja, Chunnee and Saretha.**—*Sugar News*, xii, 8, pp. 516–522; 9, pp. 579–586; 12, pp. 860–864, 1931.

No serious diseases were observed during the period of the writer's observations on the Indian sugar-cane varieties under investigation in the Philippine Islands, except for red rot (*Colleto-*

trichum falcatum) on a few stalks of Saretha, Rakhra, and Chunnee. Leaf spot caused by *Cercospora kopkei* [see next abstract] was found on Hemja, Saretha, and Chunnee.

BOLLE (P[IERRETTE] C.). **Voorloopige proeven en beschouwingen over bestrijding van de geelvlekkenziekte.** [Preliminary tests and observations on control of the yellow spot disease.] —*Arch. voor Suikerind. Nederl.-Indië*, Deel III, xxxix, 27, pp. 1189–1206, 1 graph, 1931.

After an introductory survey of the history of yellow spot disease of sugar-cane (*Cercospora kopkei*), with special reference to its occurrence in Java [*R.A.M.*, x, p. 299], the writer discusses and tabulates the results of her experiments in the control of the fungus on a P.O.J. 2961 planting on the Malang plateau.

The following preparations were used: (1) 1 per cent. alkaline or neutral copper acetate; (2) Bordeaux mixture (0·5 per cent. calcined lime in 1 per cent. copper sulphate plus 1 per cent. sugar); (3) Bordeaux mixture converted into powder by centrifuging, drying, pounding, and the addition of talc; (4) anhydrous copper sulphate and lime with talc; (5) sulphur dust ('sulphur smoke', supplied by the firm 'Internatio' at a cost of Fl. 17 per 100 kg.) [ibid., x, p. 749] mixed with 1 per cent. finely ground potassium permanganate. For the liquid sprays the Holder spraying battery was used and for the dusts the Rebschwefler Tip-top duster [ibid., vii, p. 556], both of which proved effective. Infection counts and sap analyses showed that all the fungicides except (3) reduced the incidence of *C. kopkei* and also increased the sugar content of the treated canes. They were, moreover, completely resistant to washing off, even by heavy rains. For practical purposes (5) may be specially recommended as being both economical and easy to apply. It would appear that four to six fortnightly applications during the last two or three months before an early harvest are sufficient.

SAWADA (K.). **List of fungi found in Formosa.**—103 pp., [Govt. Res. Inst., Taihoku, Formosa, ? 1931].

An alphabetical list without references is given of over 740 fungi found in Formosa, Japan [*R.A.M.*, x, p. 555], together with alphabetical host indices of scientific and common Japanese names.

LEONIAN (L. H.). **Heterothallism in Phytophthora.**—*Phytopath.*, xxi, 10, pp. 941–955, 7 figs., 1931.

With a view to extending present knowledge on the phenomenon of heterothallism in the genus *Phytophthora*, the author collected and paired in hundreds of cultures some 85 strains of *P. omnivora* in the sense previously used by him [*R.A.M.*, v, p. 5; cf. also vii, p. 602; x, p. 755] occurring largely in the tropics. Four distinct groups were segregated, viz., homothallic, heterothallic, inconstant, and neutral. The forms of the inconstant group were sometimes heterothallic and sometimes neutral (i.e., producing no oospores whether paired with strains of the opposite sex or not). Of the 48 true heterothallic cultures half were male and half female. Oogonia were produced solely as the result of mating male with

female strains on oatmeal agar, the only medium inducing sexual reproduction. Sexual reproduction ceased after about five generations, presumably on account of temporary incompatibility due to modifications in the factors responsible for chemotropic affinity.

The size of the oogonia is controlled by the female strain, a given female strain characterized by small oogonia continuing to produce similar bodies irrespective of the male strain with which it is mated. Thus, *P. palmivora* 4, from *Borassus* [*flabellifer*: ibid., ix, p. 89], when mated with any of the male strains produces oogonia measuring 35 μ, whereas those of *P. parasitica* 14, paired with the same male strains, average only 28 μ. *P. palmivora* 1, from coco-nut, forms countless oogonia when mated with any of the opposite strains, whereas *P. parasitica* 2, paired with the same male strains, gives rise to few oogonia.

It was shown by experiments [the results of which are tabulated] that no correlation exists between sexuality and the growth of the various *Phytophthora* strains in the presence of minute quantities of crystal violet and malachite green [ibid., ix, pp. 327, 809]. It was further ascertained that, generally speaking, strains of the *P. parasitica* type are more resistant to dyes than those of the *P. faberi* or *P. palmivora* group.

HOPKINS (J. C. F.). **Diseases of Tobacco in Southern Rhodesia.** —93 pp., 17 pl. (6 col.), 14 figs., Min. Agric. & Lands, Southern Rhodesia, 1931.

This useful and well illustrated handbook is primarily intended for the guidance of practical growers of tobacco in Southern Rhodesia, and contains a wealth of information, for the most part couched in popular language, regarding the correct laying-out and conduct of tobacco seed-beds and plantations. Popular accounts are also given of the parasitic and physiological diseases that attack this crop, with particular reference to those that occur and have been studied in South Africa, including recommendations for their control. Notes on some of the organisms involved in the diseases, of technical interest to mycologists, are included in an appendix; of these the following may be noticed.

The leaf spotting which until recently was attributed to *Phyllosticta nicotiana* alone [*R.A.M.*, vi, p. 715], has now been differentiated into two separate forms, namely, shot hole caused by *P. nicotiana*, and leaf blotch caused by *P. tabaci*. In the field the former is characterized by minute white spots that gradually increase up to a diameter of an eighth of an inch, when the diseased tissue dries up and falls out; in late stages the whole of the leaf blade may be thus practically destroyed, leaving only a skeleton of the larger veins with some white tissue still adhering to them, in which the pycnidia of the fungus are embedded. The disease is frequent in seed-beds on chlorotic plants (this constituting a serious source of field infection), on which the usual symptoms are white blotches up to ½ inch in diameter, but without the shot hole effect. Leaf blotch (*P. tabaci*) first appears on the upper surface of the leaf as small, light brown spots about ⅛ inch. in diameter, enlarging to form roughly circular, slightly zonate blotches up to 3 inches across; in severe cases most of the leaf tissues may be killed and reduced

to a mass of shreds. This form occurs more or less severely in one district, but is not generally considered to be of great importance in Southern Rhodesia.

Of the two species of *Alternaria* associated with leaf spots which have shown to be parasitic, the one referred to *A. tabacina* has been dealt with in some detail in a recent paper of the author [ibid., xi, p. 134], the only additional information being that this fungus exhibits considerable polymorphism according to the substratum. The other species is placed in the *A. solani* group and referred to *A. longipes* [ibid., x, p. 763], in spite of a discrepancy in spore measurements (40 to 50 by 15 to 20 for Ellis's and Everhart's fungus, as against 90 to 275 by 9 to 20 for the Rhodesian fungus), as it is possible that the long stipe mentioned by earlier authors was really the beak. A comparison with *A. macrospora* from cotton in Nigeria and Uganda showed that it is not identical with the latter. The disease caused by *A. longipes* on tobacco is named early blight, because of its similarity in symptoms with this disease in the potato.

CALDWELL (J.). **The physiology of virus diseases in plants. II. Further studies on the movement of mosaic in the Tomato plant.**—*Ann. of Appl. Biol.*, xviii, 3, pp. 279–298, 4 pl., 1 fig., 1931.

The results of further experiments [a full description and discussion of which are given] on the translocation of the aucuba mosaic virus in the tomato plant [*R.A.M.*, x, p. 66] (with which that of tobacco mosaic was shown to be similar in tobacco and tomato plants) indicated that the filtered infective juice was readily absorbed at the cut end of a petiole and thence passed into the xylem vessels of the main stem. When the petiole stump was left attached to the experimental plant, aucuba mosaic symptoms developed in the usual manner; on the other hand, when the stump was removed under aseptic conditions within 48 hours of inoculation, no symptoms followed. That the virus was present in the vessels was shown by the fact that mosaic appeared after the normal period of incubation when the leaves above the removed petiole was crushed so as to rupture the bundles, even in the plants in which the intermediate portion of the stem had been killed by steaming [loc. cit.]. The active agent was evidently carried mechanically in the xylem vessels across the dead tissue. Crushing of the leaves above the steamed stem portion did not, however, induce the appearance of the symptoms in plants which had been subjected to leaf inoculation by rubbing with wool soaked in virus juice below the dead internode. The liquid exuding from the hydathodes of infected plants was shown not to contain the active agent.

These experiments are interpreted to show that normally the virus agent does not enter the water stream of the plants, but if introduced experimentally, it is carried round in the xylem vessels, from which it cannot, however, pass into the ground tissues and phloem unless the vessels are mechanically injured, e.g., by crushing. All the indications are that the agent cannot enter an unbroken cell, nor move through or out of dead cells; because of the

latter fact great care must be taken to ensure that aucuba mosaic inocula tested in artificial infection experiments should be free from any trace of substances toxic to the host cells.

Inside the ground and meristematic tissues there was evidence that the active agent travels along the protoplasmic strands both upward and downward, the rate of progress being slightly greater in the first than in the second direction, probably owing to the greater metabolic activity in the upper portion of the plant. The removal of large portions of the vascular tissue from the stems did not appear to delay the movement of the agent up the stem. Darkness did not appear to have any effect on the multiplication of the virus in the tissues; too prolonged exposure in darkness, however, caused the permanent wilting of both diseased and healthy tomato plants, brought about, it is believed, by physiological causes.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. Nachrichtenbl. Deutsch. Pflanzenschutzdienst*, iii, 4, pp. 164, 183–188, 193, 1931.

GERMANY. An enactment of 28th June, 1931, prescribes the measures to be taken for the control of elm disease (*Graphium ulmi*) in Prussia, which are practically identical with those in force in Bremen [*R.A.M.*, x, p. 752]. Similar regulations were adopted in Lower Silesia and Schleswig-Holstein on 11th and 21st July, 1931, respectively.

UNION OF SOUTH AFRICA. By Proclamation No. 173 of 21st April, 1931, the provisions of Act 6 of 1924 (amending the Agricultural Pests Act 11 of 1911) [ibid., iii, p. 752] are extended to include the seeds of elm (all species of *Ulmus*), lucerne, tea, and tomato.

BRITTON (W. E.). **Quarantine regulations affecting shipments of Connecticut nursery stock, 1931.**—*Connecticut Agric. Exper. Stat. Circ.* 79, pp. 55–62, 5 maps, 1931.

The State of Connecticut has legally established control areas round twelve nurseries in order that five-leafed pines may be grown in areas free from blister rust [*Cronartium ribicola*: *R.A.M.*, x, p. 352; xi, p. 143]. Under the revised regulations of Federal Quarantine No. 63 yellow flowering currants (*Ribes aureum* and *R. odoratum*) may not be shipped into New York State or Rhode Island. No shipments of black currant (*R. nigrum*) are permitted. Red, white, and mountain (*R. alpinum*) currants and gooseberries may be moved between different States or from place to place in Connecticut only between 20th September and 15th May, provided that (*a*) if shipped in autumn, the plants shall be defoliated; (*b*) if in spring, they shall be free from the preceding year's leaves; and (*c*) before movement they shall be immersed (except the roots) in lime-sulphur (1 in 8, 32° Baumé).